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OFFICE OF THE SECRETARY OF DEFENSE WASHINGTON DC
JUSTIFICATION OF ESTIMATES FOR FISCAL YEAR 1983 SUBMITTED TO CO--ETC(U)
FEB 82

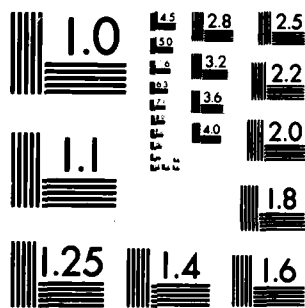
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

OFFICE OF THE
SECRETARY OF DEFENSE

JUSTIFICATION OF ESTIMATES FOR FISCAL YEAR 1983
SUBMITTED TO CONGRESS

FEBRUARY 1982



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RESEARCH, DEVELOPMENT TEST AND EVALUATION DEFENSE AGENCIES	TAB A
DIRECTOR OF TEST AND EVALUATION, DEFENSE	B

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DEPARTMENT OF DEFENSE - MILITARY
JUSTIFICATION OF ESTIMATES

APPROPRIATIONS: RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
DIRECTORATE FOR TEST AND EVALUATION, DEFENSE

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(Indexed to Descriptive Summaries)												



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APPROPRIATION LANGUAGE

Research, Development, Test and Evaluation, Defense Agencies

For expenses of activities and agencies of the Department of Defense (other than the military departments), necessary for basic and applied scientific research, development, test and evaluation; advanced research projects as may be designated and determined by the Secretary of Defense, pursuant to law; maintenance, rehabilitation, lease, and operation of facilities and equipment, as authorized by law; [\$1,692,646,000] \$2,259,800,000 to remain available for obligation until September 30, [1983] 1984: Provided, That such amounts as may be determined by the Secretary of Defense to have been made available in other appropriations available to the Department of Defense during the current fiscal year for programs related to advanced research may be transferred to and merged with this appropriation to be available for the same purposes and time period: Provided further, That such amounts of this appropriation as may be determined by the Secretary of Defense may be transferred to carry out the purposes of advanced research to those appropriations for military functions under the Department of Defense which are being utilized for related programs to be merged with and to be available for the same time period as the appropriation to which transferred. (Department of Defense Appropriation Act, 1982; additional authorizing legislation to be proposed.)

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RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
TOA SUMMARY BY DEFENSE AGENCY
(\$ in Thousands)

<u>AGENCY</u>	<u>FY 1981 ACTUAL</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>
DEFENSE MAPPING AGENCY	20,148			
DEPARTMENT OF DEFENSE (OSD AND OASDS)	21,293	20,900	31,800	34,144
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY	580,184	676,262	756,800	954,154
NATIONAL SECURITY AGENCY				
DEFENSE NUCLEAR AGENCY	199,771	259,757	326,600	357,547
DEFENSE RECONNAISSANCE SUPPORT PROGRAM				
DEFENSE COMMUNICATIONS AGENCY	52,603	105,260	107,725	93,087
DEFENSE INTELLIGENCE AGENCY				
DEFENSE LOGISTICS AGENCY	16,215	17,774	22,700	25,005
UNIFORMED SERVICES UNIVERSITY OF HEALTH SCIENCES	1,400	1,650	1,800	1,824
 TOTAL, RDT&E, DEFENSE AGENCIES	 1,308,948	 1,697,646	 2,259,900	 2,912,069
DIRECTOR, TEST & EVALUATION, DEFENSE	42,100	53,000	60,000	63,702
 GRAND TOTAL	 1,351,048	 1,750,646	 2,319,900	 2,975,771

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Research, Development, Test, and Evaluation, Defense Agencies

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Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
1.	Technology base	774,278	929,893	1,077,100	743,967	928,718	1,047,200	
3.	Strategic programs	38,224	84,341	86,100	40,678	77,660	85,700	
4.	Tactical programs		2,719	700		2,469	900	
5.	Intelligence and communications	451,881	634,243	1,033,400	431,647	625,079	1,018,200	
6.	Defensewide mission support	44,585	46,450	62,600	39,348	47,874	65,300	
Total direct		1,308,948	1,697,646	2,259,900	1,255,640	1,681,800	2,217,300	
Reimbursable program		23,435	27,500	29,500	21,995	29,300	29,700	
10.0001	Total	1,332,383	1,725,146	2,289,400	1,277,635	1,711,100	2,247,000	
Financing:								
Offsetting collections from:								
11.0001	Federal funds	-20,437	-25,900	-25,500	-20,278	-25,900	-25,500	
13.0001	Trust funds	-2,998	-1,600	-4,000	-2,998	-1,600	-4,000	
Unobligated balance available, start of year:								
21.4001	For completion of prior year budget plans				-65,793	-115,358	-129,404	
21.4002	Reprogramming from or to prior year budget plan	-5,024						
24.4001	Unobligated balance available, end of year				115,358	129,404	171,804	
25.0001	Unobligated balance lapsing	5,024			5,024			
39.0001	Budget authority	1,308,948	1,697,646	2,259,900	1,308,948	1,697,646	2,259,900	
Budget authority:								
40.0001	Appropriation	1,298,948	1,692,646	2,259,900	1,298,948	1,692,646	2,259,900	
42.0001	Transferred from other accounts	10,000	5,000		10,000	5,000		
43.0001	Appropriation (adjusted)	1,308,948	1,697,646	2,259,900	1,308,948	1,697,646	2,259,900	
Relation of obligations to outlays:								
71.0001	Obligations incurred, net				1,254,359	1,683,600	2,217,500	
72.4001	Obligated balance, start of year				497,545	593,072	768,072	
74.4001	Obligated balance, end of year				-593,072	-768,072	-1,020,572	
77.0001	Adjustments in expired accounts				1,209			
90.0001	Outlays				1,180,041	1,508,600	1,965,000	

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Research, Development, Test, and Evaluation, Defense Agencies

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Object Classification (in thousands of dollars)

Identification code 97-0400-0-1-051

1981 actual 1982 est. 1983 est.

Direct obligations:

111.101	Personnel compensation:			
	Full-time permanent	16,733	19,099	20,731
111.301	Other than full-time permanent	127	36	54
111.501	Other personnel compensation	282	126	134
111.801	Special personal services payments	81	55	55
111.901	Total personnel compensation	17,223	19,316	20,974
112.101	Civilian personnel	1,637	1,971	2,139
121.001	Travel and transportation of persons	6,791	9,431	10,679
122.001	Transportation of things	235	856	1,528
123.101	Standard level user charges	379	460	460
123.201	Communications, utilities and other rent	7,947	9,005	10,486
124.001	Printing and reproduction	343	450	485
	Other services:			
125.002	Purchases from industrial funds	49,551	52,549	81,906
125.003	Contracts	1,013,963	1,362,269	1,812,217
125.004	Other	88,835	135,834	155,767
126.001	Supplies and materials	9,813	9,308	12,122
131.001	Equipment	58,923	60,151	108,137
141.001	Grants, subsidies, and contributions		200	400
199.001	Total direct obligations	1,255,640	1,681,600	2,217,300

Reimbursable obligations:

211.101	Personnel compensation:			
	Full-time permanent	700	439	479
211.301	Other than full-time permanent	34	498	576
211.901	Total personnel compensation	734	937	1,055
212.101	Civilian personnel	70	85	97
221.001	Travel and transportation of persons	21	30	34
222.001	Transportation of things		3	3
223.201	Communications, utilities and other rent	26	75	90
224.001	Printing and reproduction	1	4	5
	Other services:			
225.003	Contracts	19,782	24,182	26,591
225.004	Other	372	2,653	765
226.001	Supplies and materials	474	752	817
231.001	Equipment	528	371	233
241.001	Grants, subsidies, and contributions	7	6	10
004	Total reimbursable obligations	21,995	29,300	29,700
	Total obligations	1,277,635	1,711,100	2,247,000

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RDT&E DEFENSE AGENCIES

PERSONNEL SUMMARY

	FY 1981 <u>ACTUAL</u>	FY 1982 <u>ESTIMATE</u>	FY 1983 <u>ESTIMATE</u>
TOTAL NUMBER OF PERMANENT POSITIONS	717	797	839
TOTAL COMPENSABLE WORK YEARS:			
FULL-TIME EQUIVALENT OF OTHER POSITIONS	725	768	814
FULL-TIME EQUIVALENT OF OVERTIME AND HOLIDAY LEAVE	10	11	11
AVERAGE ES SALARY	\$50,112	\$58,067	\$58,152
AVERAGE GS GRADE	8.94	8.91	8.89
AVERAGE GS SALARY	\$23,991	\$25,195	\$25,382
AVERAGE SALARY OF UNGRADED POSITIONS	\$18,761	\$19,667	\$20,513

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RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
SUMMARY BY BUDGET ACTIVITY
(\$ in Thousands)

<u>BUDGET ACTIVITY</u>	<u>FY 1981 ACTUAL</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>
1. Technology Base	774,278	929,893	1,077,100	1,305,325
3. Strategic Programs	38,224	84,341	86,100	70,245
4. Tactical Programs		2,719	700	746
5. Intelligence & Communications	451,861	634,243	1,033,400	1,468,404
6. Defensewide Mission Support	<u>44,585</u>	<u>46,450</u>	<u>62,600</u>	<u>67,349</u>
TOTAL RDT&E - DIRECT	1,308,948	1,697,646	2,259,900	2,912,069
REIMBURSABLE	<u>23,435</u>	<u>27,500</u>	<u>29,500</u>	<u>29,800</u>
TOTAL PROGRAM	1,332,383	1,725,146	2,289,400	2,941,869

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
SUMMARY BY PROGRAM CATEGORY
(\$ in Thousands)

<u>PROGRAM CATEGORY</u>	<u>FY 1981 ACTUAL</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>
6.1 Research	102,414	93,050	113,900	146,824
6.2 Exploratory Development	671,864	836,843	963,200	1,158,501
6.3 Advanced Development	15,054	17,166	19,125	19,984
6.4 Engineering Development	5,883	6,034	10,082	12,667
6.5 Management and Support	<u>44,585</u>	<u>46,450</u>	<u>62,600</u>	<u>67,349</u>
TOTAL, RESEARCH & DEVELOPMENT (Program 6)	839,800	999,543	1,168,907	1,405,325
TOTAL, OPERATIONAL SYSTEMS	<u>469,148</u>	<u>698,103</u>	<u>1,090,993</u>	<u>1,506,744</u>
TOTAL DIRECT	1,038,948	1,697,646	2,259,900	2,912,069
REIMBURSABLE	<u>23,435</u>	<u>27,500</u>	<u>29,500</u>	<u>29,800</u>
TOTAL PROGRAM	1,332,383	1,725,146	2,289,400	2,941,869

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**DEFENSE AGENCIES
FY 1983 R D T & E PROGRAM**

EXHIBIT R-1

APPROPRIATION 0400 D RESEARCH DEVELOPMENT TEST + EVAL, DEF AGENCIES

DATE 08 FEB 1982

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	ACT	THOUSANDS OF DOLLARS				S E C
			FY 1981	FY 1982	FY 1983	FY 1984	
1	62100E DEFENSE RESEARCH SCIENCES	1	101,014	91,400	112,100	145,000	U
2	62101W IN-HOUSE LAB INDEPENDENT RESEARCH	1	1,400	1,650	1,800	1,824	U
3	62101E TECHNICAL STUDIES	1	3,145	3,000	3,300	3,600	U
4	62301E STRATEGIC TECHNOLOGY	1	125,354	148,631	151,900	160,000	U
5	62702E TACTICAL TECHNOLOGY	1	84,348	80,415	93,900	126,200	U
6	62707E PARTICLE BEAM TECHNOLOGY	1		32,500	31,000	31,000	U
7	62708E INTEGRATED CMD/CONTROL TECH	1	32,752	45,400	55,300	62,800	U
8	62711E EXPERIMENTAL EVAL MAJ INNOVATIVE TECH	1	199,449	237,040	268,500	375,554	U
9	62712E MATERIALS PROCESSING TECH	1	11,977	13,300	15,400	19,300	U
10	62713E NUCLEAR MONITORING	1	15,068	16,800	17,300	22,500	U
11	62713B DEFENSE NUCLEAR AGENCY	1	199,771	259,757	326,600	357,547	U
	TECHNOLOGY BASE		774,278	929,893	1,077,100	1,305,125	
12	63735E WWMCCS ARCHITECTURE	3	789	1,166	1,262	1,400	U
13	32016K WWMCCS WIDE SUPPORT	3	5,284	9,278	7,906	8,570	U
14	32017K WWMCCS ADP-JTSA	3	5,787	14,261	23,355	19,955	U
15	32019K WWMCCS SYSTEM ENGINEER	3	22,774	49,289	43,732	29,327	U
16	33131K MINIMUM ESSENTIAL EMER COMM NETWORK	3	3,590	6,483	9,645	10,933	U
17	33152K WWMCCS INFORMATION SYSTEM	3		3,864			U
	STRATEGIC PROGRAMS		38,224	84,341	86,100	70,245	

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DEFENSE AGENCIES
FY 1983 R D T & E PROGRAM

EXHIBIT R-1

APPROPRIATION 0400 D RESEARCH DEVELOPMENT TEST & EVAL, DEF AGENCIES

DATE: 08 FEB 1982

LINE NO	PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	ACT	THOUSANDS OF DOLLARS				S E C
				FY 1981	FY 1982	FY 1983	FY 1984	
18	310000	INITIATIVES	4		2,719	700	746	U
19	310500	ENG. DRAW. GEODESY INV/PRO OTYPE DEV	5	14,265	16,000	17,863	18,584	U
20	310700	MAP. CHART. GEODESY ENGR DEV/TEST	5	5,883	6,034	10,082	12,667	U
21	310800	CRYPTOLOGIC ACTIVITIES	5					
22	313000	GENERAL DEFENSE INTELLIGENCE PROGRAM	5					
23	331260	LONG-HAUL COMM. LATIONS (DCS)	5	14,379	18,200	18,935	19,136	U
24	331270	SUPPORT OF THE NCS	5			1,990	2,960	U
25	334000	COMMUNICATIONS SECURITY	5					
26								
27	310500	DEFENSE RECONNAISSANCE SUPPORT ACTIVITIES	5					
28	310500	COMINT. SECURITY	5					
29	310500	TACTICAL CRYPTOLOGIC ACTIVITIES	5					
		INTELLIGENCE AND COMMUNICATIONS		451,861	634,243	1,033,400	1,466,404	

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DEFENSE AGENCIES
FY 1983 R D T & E PROGRAM

EXHIBIT R-1

APPROPRIATION: UNCLASSIFIED RESEARCH DEVELOPMENT TEST + EVAL, DEF AGENCIES

DATE: 08 FEB 1982

LINE NO	PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	ACT	THOUSANDS OF DOLLARS				S E C
				FY 1981	FY 1982	FY 1983	FY 1984	
30	65104D	TECHNICAL SUPPORT TO USDR/E	6	11,200	12,100	18,649	19,719	U
31	65106D	GENERAL SUPPORT FOR PA/E	6	2,205	2,200	3,712	4,294	U
32	65107D	SUPPORT TO POLICY	6	3,355	2,100	4,419	1,652	U
33	65108D	GENERAL SUPPORT FOR NET ASSESSMENT	6	1,918	1,900	4,006	4,847	U
34	65109D	GENERAL SUPPORT FOR MRA/L	6	2,615	2,600	3,014	3,632	U
35	65607S	DEFENSE TECHNICAL INFO CENTER	6	13,233	14,574	17,560	18,343	U
36	65102D	INFORMATION ANALYSIS CENTERS	6	2,982	3,200	5,140	6,662	U
47	65908D	TECHNICAL RESEARCH DEVELOPMENT	6	7,077	7,776	8,100	8,200	U
		TECHNICAL SUPPORT		44,585	46,450	62,600	67,349	
TOTAL RESEARCH DEVELOPMENT TEST + EVAL, DEF AGENCIES				1,308,948	1,697,646	2,259,900	2,912,069	

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Research, Development, Test, and Evaluation, Defense Agencies

08 FEB 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code		Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	1. Technology base	.....	.....	.....	13,580	.....	.....
	3. Strategic programs	.....	.....	.....	5,430	.....	.....
	5. Intelligence and communications	.....	.....	.....	38,635	.....	.....
	6. Defensewide mission support	.....	.....	.....	2,398	.....	.....
	Total direct	.....	.....	.....	60,043	.....	.....
	Reimbursable program	.....	.....	.....	567	.....	.....
10.0001	Total	.....	.....	.....	60,610	.....	.....
Financing:							
Offsetting collections from:							
11.0001	Federal funds	.....	.....	.....	159	.....	.....
	Unobligated balance available, start of year:	.....	.....	.....	.....	.....	.....
21.4001	For completion of prior year budget plans	.....	.....	.....	-65,793	.....	.....
21.4002	Reprogramming from or to prior year budget plan	-5,024	.....	.....	.....	.....	.....
25.0001	Unobligated balance lapsing	5,024	5,024
40.0001	Budget authority (appropriation)

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Research, Development, Test, and Evaluation, Defense Agencies

08 FEB 82

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
1.	Technology base	774,278			730,387	43,891		
3.	Strategic programs	38,224			35,248	2,976		
5.	Intelligence and communications	451,861			393,012	58,849		
6.	Defensewide mission support	44,586			36,950	7,635		
	Total direct	1,308,948			1,195,597	113,351		
	Reimbursable program	23,435			21,428	2,007		
10 0001	Total	1,332,383			1,217,025	115,358		
Financing:								
Offsetting collections from:								
11 0001	Federal funds	-20,437			-20,437			
13 0001	Trust funds	-2,998			-2,998			
21 4001	Unobligated balance available, start of year					-115,358		
24 4001	Unobligated balance available, end of year				115,358			
39 0001	Budget authority	1,308,948			1,308,948			
Budget authority:								
40 0001	Appropriation	1,298,948			1,298,948			
42 0001	Transferred from other accounts	10,000			10,000			
43 0001	Appropriation (adjusted)	1,308,948			1,308,948			

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Research, Development, Test, and Evaluation, Defense Agencies

08 FEB 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code		Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	1. Technology base		929,893			884,827	45,066
	3. Strategic programs		84,341			74,684	9,657
	4. Tactical programs		2,719			2,469	250
	5. Intelligence and communications		634,243			566,230	68,013
	6. Defensewide mission support		46,450			40,239	6,211
	Total direct		1,697,646			1,568,449	129,197
	Reimbursable program		27,500			27,293	207
10.0001	Total		1,725,146			1,595,742	129,404
Financing:							
Offsetting collections from:							
11.0001	Federal funds		-25,900			-25,900	
13.0001	Trust funds		-1,600			-1,600	
21.4001	Unobligated balance available, start of year						-129,404
24.4001	Unobligated balance available, end of year					129,404	
39.0001	Budget authority		1,697,646			1,697,646	
Budget authority:							
40.0001	Appropriation		1,692,646			1,692,646	
42.0001	Transferred from other accounts		5,000			5,000	
43.0001	Appropriation (adjusted)		1,697,646			1,697,646	

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HESSLER
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Research, Development, Test, and Evaluation, Defense Agencies

08 FEB 82

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code 97-0400-0-1-051

Budget plan (amounts for
RDT&E actions programmed)

Obligations

	1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:						
Direct:						
1. Technology base			1,077,100			1,002,134
3. Strategic programs			86,100			76,043
4. Tactical programs			700			850
5. Intelligence and communications			1,033,400			950,187
6. Defensewide mission support			62,600			59,089
Total direct			2,259,900			2,088,103
Reimbursable program			29,500			29,493
10.0001 Total			2,289,400			2,117,596
Financing:						
Offsetting collections from:						
11.0001 Federal funds			-25,500			-25,500
13.0001 Trust funds			-4,000			-4,000
24.4001 Unobligated balance available, end of year						171,804
40.0001 Budget authority (appropriation)			2,259,900			2,259,900

RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
PERFORMER DISTRIBUTION
(\$ in Thousands)

	<u>FY 1981 ACTUAL</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>
1. For operation of installation of the reporting development agency - <u>Government Operated</u>	63,246	72,367	78,280	83,725
2. For operation of installation of the reporting development agency - <u>Contractor Operated</u>				
3. For contracts directly in support of work actually performed at installations of the reporting development agency	5,691	6,140	8,041	9,918
4. For work assigned to other DoD activities	185,934	257,674	359,114	440,974
5. For work assigned to activities of other government agencies	25,359	45,413	74,864	85,187
6. For work performed by industrial contractors	857,970	1,111,278	1,507,891	2,020,903
7. For work performed by educational institutions:				
a. Designated FCRC	15,060	19,350	18,600	15,225
b. Other Institutions	86,927	97,522	110,866	137,018
8. For work performed by other "non-profit" organizations:				
a. Designated FCRC	42,437	51,550	59,492	66,717
b. Other Institutions	<u>26,324</u>	<u>36,352</u>	<u>42,752</u>	<u>52,402</u>
9. Total R&D Appropriation	1,308,948	1,697,646	2,259,900	2,912,069

DEPARTMENT OF DEFENSE - MILITARY
JUSTIFICATION OF ESTIMATES FOR FY 1983

Appropriations: Research, Development, Test and Evaluation, Defense Agencies
Director, Test and Evaluation, and O&M, Defense Agencies

FEDERAL CONTRACT RESEARCH CENTERS

The Summary of Federal Contract Research Centers (FCRCs) reflects a consolidation of funding requirements for certain contractors who assist the Defense Agencies in the planning, development, and execution of the Research, Development, Test and Evaluation program. These contractors provide specialized technical and scientific support to supplement that available within the Defense Agencies. Following the Summary, there is a detailed tabulation listing the amounts provided in FY 1981, 1982, 1983, and 1984 for each of the various contractors.

The Defense Agencies total FY 1983 estimates for the FCRCs amount to \$91,053,000 (excluding subcontract effort), of which \$78,092,000 is in the RDT&E Defense Agencies appropriation, \$8,553,000 is in the O&M, Defense Agencies, appropriation, and \$4,408,000 in the DT&E appropriation.

In addition to the consolidated tables shown in this section, there is presentation under the separate Defense Agency tabs of each agency supporting FCRC detail.

SUMMARY OF FEDERAL CONTRACT RESEARCH CENTERS BY APPROPRIATION
(\$ in Thousands)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Mitre Corporation				
RDT&E, Defense Agencies	15,170	18,726	21,527	26,042
Director, Test & Evaluation	877	993	1,108	1,222
O&M, Defense Agencies	4,919	6,043	8,414	9,192
Institute for Defense Analysis				
RDT&E, Defense Agencies	19,315	21,389	25,229	26,475
Director, Test & Evaluation	2,275	3,500	3,300	3,650
Aerospace Corporation				
RDT&E, Defense Agencies	6,827	10,735	11,886	13,250
O&M, Defense Agencies	119	100	139	148
Lincoln Laboratories				
RDT&E, Defense Agencies	16,185	20,050	19,450	16,175
Total Program Summary				
RDT&E, Defense Agencies	57,497	70,900	78,092	81,942
O&M, Defense Agencies	5,038	6,143	8,553	9,340
Director, Test & Evaluation	<u>3,152</u>	<u>4,493</u>	<u>4,408</u>	<u>4,872</u>
Total Federal Contract Research Centers	65,687	81,536	91,053	96,154

DETAIL OF FCRC
(\$ in Thousands)

	<u>FY 1981 ACTUAL</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>
Mitre Corporation				
<u>RD&E Appropriation</u>				
<u>Supporting Agency:</u>				
Defense Advanced Research Pro- jects Agency (DARPA)	1,356	2,166	2,520	2,800
Defense Communications Agency	11,014	13,394	14,590	17,900
Office, Secretary of Defense	370	477	346	412
Other (Classified)	<u>2,430</u>	<u>2,689</u>	<u>4,071</u>	<u>4,930</u>
Total, RD&E Appropriation	15,170	18,726	21,527	26,042
<u>O&M Appropriation</u>				
<u>Supporting Agency:</u>				
Defense Communications Agency	1,549	2,329	4,270	4,900
Office, Secretary of Defense	3,330	3,474	4,144	4,292
Other (Classified)	<u>40</u>	<u>240</u>		
Total, O&M Appropriation	4,919	6,043	8,414	9,192
<u>DT&E Appropriation</u>				
<u>Supporting Agency:</u>				
Test & Evaluation, OUSDRE	<u>877</u>	<u>993</u>	<u>1,108</u>	<u>1,222</u>
TOTAL, Mitre Corporation	20,966	25,762	31,049	36,456

DETAIL OF FCRC
(\$ in Thousands)

	<u>FY 1981</u> <u>ACTUAL</u>	<u>FY 1982</u> <u>ESTIMATE</u>	<u>FY 1983</u> <u>ESTIMATE</u>	<u>FY 1984</u> <u>ESTIMATE</u>
<u>Institute for Defense Analysis</u>				
<u> RDT&E Appropriation</u>				
<u>Supporting Agency:</u>				
Defense Advanced Research Pro-	4,330	5,100	5,800	6,000
jects Agency (DARPA)				
Defense Communications Agency	220	625	1,200	1,300
Other (Classified)	7,380	7,792	8,179	8,275
Office, Secretary of Defense	7,374	7,820	9,900	10,750
Defense Logistics Agency	11	52	150	150
Total, RDT&E Appropriation	19,315	21,389	25,229	26,475
<u> DT&E Appropriation</u>				
<u>Supporting Agency:</u>				
Test & Evaluation, OUSDRE	2,275	3,500	3,300	3,650
TOTAL, Institute for Defense	21,590	24,889	28,529	30,125
Analysis				
<u>Aerospace Corporation</u>				
<u> RDT&E Appropriation</u>				
<u>Supporting Agency:</u>				
Defense Advanced Research Pro-	5,453	8,055	8,810	9,480
jects Agency (DARPA)				
Defense Mapping Agency	125	175	125	125
Defense Nuclear Agency	350	500	700	675
Office, Secretary of Defense	115	200	225	270
Other (Classified)	784	1,805	2,026	2,700
Total, RDT&E Appropriation	6,827	10,735	11,886	13,250

DETAIL OF FCRC
(\$ in Thousands)

	<u>FY 1981</u> <u>ACTUAL</u>	<u>FY 1982</u> <u>ESTIMATE</u>	<u>FY 1983</u> <u>ESTIMATE</u>	<u>FY 1984</u> <u>ESTIMATE</u>
<u>Aerospace Corporation (Cont)</u>				
<u>O&M Appropriation</u>				
Supporting Agency:				
Other (Classified)	<u>119</u>	<u>100</u>	<u>139</u>	<u>148</u>
TOTAL, Aerospace Corporation	6,946	10,835	12,025	13,398
<u>Lincoln Laboratory</u>				
<u>RD&E Appropriation</u>				
Supporting Agency:				
Defense Advanced Research Pro- jects Agency (DARPA)	15,060	19,350	18,600	15,225
Other (Classified)	<u>1,125</u>	<u>700</u>	<u>850</u>	<u>950</u>
TOTAL, Lincoln Laboratory, RD&E Appropriation	16,185	20,050	19,450	16,175

DEPARTMENT OF DEFENSE - MILITARY
Research, Development, Test and Evaluation
Installation Analysis

INSTITUTE FOR DEFENSE ANALYSES (IDA)

The Institute for Defense Analyses, a not-for-profit Federal Contract Research Center, was established in 1956 at the request of the Secretary of Defense. Its purpose is to promote the national security, the public welfare, and the advancement of scientific learning by making analyses, evaluations, and reports on matters of interest to the United States Government with primary orientation toward matters of national security. In practice, IDA is primarily dedicated to the Department of Defense for tasks sponsored by the Under Secretary of Defense for Research and Engineering, the Joint Chiefs of Staff, and other elements of the Office of the Secretary of Defense, including Defense Agencies.

		<u>TOA (\$ in Thousands)</u>			<u>PERSONNEL^{1/}</u>				
		<u>From Parent Dept.</u>	<u>All Other Funds</u>	<u>Total</u>	<u>Professional</u>		<u>Support^{2/}</u>		<u>Total</u>
<u>FCRC & Location</u>	<u>FY</u>				<u>Paid From Parent Dept. RDT&E</u>	<u>Paid From Other</u>	<u>Paid From Parent Dept. RDT&E</u>	<u>Paid From Other</u>	
Institute for Defense Analyses	1981	21,689	500	22,189	203	5	254	6	260
Arlington, Va. and Princeton, N.J.	1982	25,087	500	25,587	209	4	261	5	266
	1983	28,379	500	28,879	218	4	273	5	278
	1984	30,125	500	30,625	215	4	269	5	274

^{1/} No military personnel are assigned to IDA

^{2/} Includes Corporate and Division Management and mission support personnel such as guard force, document control, personnel, finance, reproduction, and other administrative services.

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Research, Development, Test, and Evaluation, Defense Agencies

DARPA

08 FEB 82

Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
	1. Technology base	573,107	668,486	748,700	545,482	682,457	720,308	
	6. Defensewide mission support	7,077	7,776	8,100	6,739	8,238	8,086	
	Total direct	580,184	676,262	756,800	552,221	690,695	728,394	
	Reimbursable program	8,356	8,000	8,500	8,356	8,000	8,500	
10.0001	Total	588,540	684,262	765,300	560,577	698,695	736,894	
Financing:								
Offsetting collections from:								
11.0001	Federal funds	-8,356	-8,000	-8,500	-8,356	-8,000	-8,500	
	Unobligated balance available, start of year:							
21.4001	For completion of prior year budget plans				-15,407	-41,483	-27,050	
21.4002	Reprogramming from or to prior year budget plan	-1,887						
24.4001	Unobligated balance available, end of year				41,483	27,050	55,456	
25.0001	Unobligated balance lapsing	1,887			1,887			
40.0001	Budget authority (appropriation)	580,184	676,262	756,800	580,184	676,262	756,800	

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Research, Development, Test, and Evaluation, Defense Agencies

DARPA

08 FEB 82

Object Classification (in thousands of dollars)

Identification code	97-0400-0-1-051	1981 actual	1982 est.	1983 est.
Direct obligations:				
Personnel compensation:				
111.101	Full-time permanent	3,565	4,183	4,433
111.501	Other personnel compensation	36	45	50
111.801	Special personal services payments	81	55	55
111.901	Total personnel compensation	3,682	4,283	4,538
112.101	Civilian personnel	309	428	448
121.001	Travel and transportation of persons	2,296	2,939	3,300
122.001	Transportation of things		2	2
123.101	Standard level user charges	379	460	460
123.201	Communications, utilities and other rent	4,715	4,717	5,174
124.001	Printing and reproduction	164	225	240
Other services:				
125.002	Purchases from industrial funds	49,551	52,549	81,906
125.003	Contracts	483,694	617,152	625,915
125.004	Other	59	121	151
126.001	Supplies and materials	43	76	86
131.001	Equipment	7,329	7,743	6,174
199.001	Total direct obligations	552,221	690,695	728,394
Reimbursable obligations:				
Other services:				
225.003	Contracts	8,356	8,000	8,500
999.901	Total obligations	560,577	698,695	736,894

DEPARTMENT OF DEFENSE - MILITARY
 DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
 RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
 PERSONNEL SUMMARY

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Total Number of Full Time Permanent Positions	106	118	126	126
Total Compensable Workyears:				
Full Time Equivalent Employment	(109)	(121)	(129)	(129)
Full Time Equivalent Overtime & Hoilday Hours	(2)	(2)	(2)	(2)
Average ES Salary	50,112	58,125	58,125	58,312
Average GS Grade	10.09	10.09	10.23	10.23
Average GS Salary	27,805	29,570	29,505	29,733

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
SUMMARY BY BUDGET ACTIVITY
(\$ in Thousands)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
1. Technology Base	\$573,107	\$668,486	\$748,700	\$945,954
2. Defense-Wide Mission Support	<u>7,077</u>	<u>7,776</u>	<u>8,100</u>	<u>8,200</u>
TOTAL RDT&E - DIRECT	\$580,184	\$676,262	\$756,800	\$954,154
Reimbursements	<u>8,356</u>	<u>8,000</u>	<u>8,500</u>	<u>8,500</u>
TOTAL PROGRAM	\$588,540	\$684,262	\$765,300	\$962,654

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
SUMMARY BY PROGRAM CATEGORY
(\$ in Thousands)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
6.1 Research	\$101,014	\$ 91,400	\$112,100	\$145,000
6.2 Exploratory Development	472,093	577,086	636,600	800,954
6.3 Advanced Development	---	---	---	---
6.4 Engineering Development	---	---	---	---
6.5 Defense-Wide Mission Support	<u>7,077</u>	<u>7,776</u>	<u>8,100</u>	<u>8,200</u>
Total Research and Development (Program 6)	\$580,184	\$676,262	\$756,800	\$954,154
Total Operational Systems Program	---	---	---	---
Total RDT&E - Direct	580,184	676,262	756,800	954,154
Reimbursements	<u>8,356</u>	<u>8,000</u>	<u>8,500</u>	<u>8,500</u>
TOTAL PROGRAM	\$588,540	\$684,262	\$765,300	\$962,654

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Research, Development, Test, and Evaluation, Defense Agencies

DARPA

08 FEB 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	1. Technology base				13,096		
	6. Defensewide mission support				424		
10.0001	Total				13,520		
Financing:							
	Unobligated balance available, start of year:						
21.4001	For completion of prior year budget plans				-15,407		
21.4002	Reprogramming from or to prior year budget plan	-1,887					
25.0001	Unobligated balance lapsing	1,887			1,887		
40.0001	Budget authority (appropriation)						

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	1. Technology base	573,107			532,366	40,721	
	6. Defensewide mission support	7,077			6,315	762	
	Total direct	580,184			538,701	41,483	
	Reimbursable program	8,356			8,356		
10.0001	Total	588,540			547,057	41,483	
Financing:							
	Offsetting collections from:						
11.0001	Federal funds	-8,356			-8,356		
21.4001	Unobligated balance available, start of year					-41,483	
24.4001	Unobligated balance available, end of year				41,483		
40.0001	Budget authority (appropriation)	580,184			580,184		

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Research, Development, Test, and Evaluation, Defense Agencies

DARPA

08 FEB 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct								
	1. Technology base		668,486			641,736	26,760	
	6. Defensewide mission support		7,776			7,476	300	
	Total direct		676,262			649,212	27,060	
	Reimbursable program		8,000			8,000		
10.0001	Total		684,262			657,212	27,060	
Financing:								
	Offsetting collections from:							
11.0001	Federal funds		-8,000			-8,000		
21.4001	Unobligated balance available, start of year						-27,060	
24.4001	Unobligated balance available, end of year					27,060		
40.0001	Budget authority (appropriation)		676,262			676,262		

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
	1. Technology base			748,700			693,556	
	6. Defensewide mission support			8,100			7,786	
	Total direct			756,800			701,344	
	Reimbursable program			8,500			8,500	
10.0001	Total			765,300			709,844	
Financing:								
	Offsetting collections from:							
11.0001	Federal funds			-8,500			-8,500	
24.4001	Unobligated balance available, end of year						55,456	
40.0001	Budget authority (appropriation)			766,800			766,800	

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DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
PERFORMER DISTRIBUTION
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
(\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
1. For operation of installation of the reporting DoD component <u>Government Operated</u>	\$ 7,077	\$ 7,776	\$ 8,100	\$ 8,200
2. For operation of installations of the reporting DoD component <u>Contractor Operated</u>	---	---	---	---
3. For contracts directly in support of work actually performed at installations of the reporting DoD component	---	---	---	---
4. For work assigned to other DoD activities	66,712	56,815	63,900	81,200
5. For work assigned to activities of other Government Agencies	1,786	1,890	2,300	2,900
6. For work performed by industrial contractors ("Profit" Organizations)	379,136	456,560	513,670	659,199
7. For work performed by educational institutions:				
a. Designated Federal Contract Research Centers	15,060	19,350	18,600	15,225
b. Other Institutions a/	80,294	89,299	100,400	127,600
8. For work performed by other "non-profit" organizations:				
a. Designated Federal Contract Research Centers	11,139	15,321	17,130	18,280
b. Other Institutions	18,980	29,251	32,700	41,550
9. Total R&D appropriations	580,184	676,262	756,800	954,154

a/ Includes University Affiliated Labs and FFRDC's

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
INSTALLATION ANALYSIS - IN-HOUSE

TOA (\$ in Thousands)										Personnel (Man-Years)							
Installation and Location	FY	RDT&E Funds			All Other Funds	Sub-Total	Mil. Personnel			Civil Service			Contractor		Mil. Pers		
		Mgt. Bureau	Other DARPA	Other DoD			R&D	Other	Total	Paid From	Paid From	Paid From	Paid From	Paid From	In RDT&E Work	Other	Total
										DARPA	Other	Other	RDT&E	RDT&E				Other	RDT&E	Other
Advanced test Accelerator	81	17,800	--	--	--	17,800	--	--	17,800	--	--	--	60	--	--	--	60
Lawrence Livermore National Lab (LLNL) Livermore, CA	82	9,800	--	--	--	9,800	--	--	9,800	--	--	--	60	--	--	--	60
	83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	84	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Large Optics Diamond Turning Machine (LODTM) LLNL Livermore, CA	81	4,500	--	--	--	4,500	--	--	4,500	--	--	--	30	--	--	--	30
	82	5,000	--	--	--	5,000	--	--	5,000	--	--	--	30	--	--	--	30
	83	1,000	--	--	--	1,000	--	--	1,000	--	--	--	15	--	--	--	15
	84	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

The ATA project was initiated by DARPA at LLNL in FY 1979 with the objective of providing an accelerator to produce an electron beam (50 million electron volts) permitting the experimental evaluation of electron beam atmospheric propagation over distances sufficient to determine weapons feasibility. The installation funding reflects construction costs for the ATA scheduled for completion in October 1982. The funds and man years reported and direct costs for LLNL contracted construction effort at the LLNL site.

The LODTM project, initiated by DARPA in FY 1980, is to construct a machine to fabricate large laser resonator optics with the precision required for advanced high power devices. The funding reflects the costs of constructing the machine and the facility to house it on the LLNL site. Personnel are LLNL personnel directly charged to the project, which will be completed in FY 1983.

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
INSTALLATION ANALYSIS - IN-HOUSE
(\$ in Thousands)

TOA (\$ in Thousands)

Personnel (Man-Years)

Funds (in thousands)										Personnel (in years)							
Location	FY	RDT&E Funds			All Other Funds	Sub-Total	Mil. Personnel			Civil Service			Contractor		Mil. Pers		Total
		Mgt. Bureau	Other DARPA	Other DoD			R&D	Other	Total	Paid From DARPA	Paid From Other	Paid From	Paid From	Paid From	In RDT&E Work	Other	
Mt. Haleakala (AMOS)	81	1,800	--	--	--	1,800	--	--	1,800	--	--	--	25	--	1	--	26
	82	2,240	--	--	--	2,240	--	--	2,240	--	--	--	25	--	1	--	26
Maui, Hawaii	83	2,700	--	--	--	2,700	--	--	2,700	--	--	--	25	--	1	--	26
	84	2,700	--	--	--	2,700	--	--	2,700	--	--	--	25	--	1	--	26
Acoustic Re-	81	1,800	--	1,800	--	3,600	--	37	3,637	8	--	--	36	--	1	--	45
search Center,	82	2,200	--	2,140	--	4,340	--	43	4,383	8	--	--	36	--	1	--	45
Moffett Field	83	2,000	--	2,500	--	4,500	--	43	4,543	8	--	--	36	--	1	--	45
Naval Air Sta. Sunnyvale, CA	84	2,000	--	2,500	--	4,500	--	43	4,543	8	--	--	36	--	1	--	45

This installation analysis for Mt. Haleakala reflects the financing and manpower required through FY 1984 to operate and maintain the optical testbed facility in Hawaii used for development of advanced optical techniques for Space Object Identification. The funds and man-years reported are directed costs for the contracted effort performed at the site.

The Acoustic Research Center is an RDT&E facility operated by DARPA and collocated at Naval Air Station, Moffett Field, California. Funds outlined above provide for computers and associated equipment at remote sites and at Moffett Field, as the costs of the Data Telemetry Links connecting these sites.

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
FEDERAL CONTRACT RESEARCH CENTERS
SUMMARY BY APPROPRIATION AND PROGRAM ELEMENT
(\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
<u>Institute for Defense Analyses</u>				
<u>RDT&E Defense Agencies</u>				
61101E Defense Research Sciences	330	1,250	1,580	1,665
62101E Technical Studies	3,145	3,000	3,300	3,600
62301E Strategic Technology	200	335	285	285
62702E Tactical Technology	150	300	400	450
62708E Integrated Command & Control Technology	150	-0-	-0-	-0-
62711E Experimental Evaluation of Major Innovative Technologies	<u>355</u>	<u>215</u>	<u>235</u>	<u>-0-</u>
Total IDA	4,330	5,100	5,800	6,000
 <u>Lincoln Laboratory</u>				
<u>RDT&E, Defense Agencies</u>				
<u>Internal Operations</u>				
61101E Defense Research Sciences	2,150	2,200	2,350	1,975
62301E Strategic Technology	5,200	6,775	9,000	6,200
62702E Tactical Technology	3,300	5,800	3,800	4,250
62708E Integrated Command & Control Technology	1,760	2,525	2,350	2,000
62712E Materials Processing Technology	200	400	600	800
62714E Nuclear Monitoring	<u>2,450</u>	<u>1,650</u>	<u>500</u>	<u>-0-</u>
Total Internal Operations	15,060	19,350	18,600	15,225

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FEDERAL CONTRACT RESEARCH CENTERS

		<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
<u>MITRE Corporation</u>					
<u>RDTE, Defense Agencies</u>					
61101E	Defense Research Sciences	-0-	100	250	250
62301E	Strategic Technology	100	420	435	500
62702E	Tactical Technology	676	750	950	950
62708E	Integrated Command & Control Technology	550	446	410	600
62711E	Experimental Evaluation of Major Innovative Technologies	30	250	275	300
	Office of Net Assessment	-0-	200	200	200
	Total MITRE	1,356	2,166	2,520	2,800
<u>Aerospace Corporation</u>					
<u>RDTE, Defense Agencies</u>					
61101E	Defense Research Sciences	-0-	100	300	300
62301E	Strategic Technology	3,763	5,920	6,390	6,880
62702E	Tactical Technology	-0-	-0-	-0-	-0-
62711E	Experimental Evaluation of Major Innovative Technologies	1,430	1,785	1,920	2,000
62712E	Materials Processing Technology	260	250	200	300
	Total Aerospace Corporation	5,453	8,055	8,810	9,480
	GRAND TOTAL	26,199	34,671	35,730	33,505

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
INSTALLATION ANALYSIS - FCRC's
(\$ in Thousands)

Location	FY	TOA (\$ in Thousands)							Personnel								Total
		RDT&E Funds							Professional			Support					
		Mgmt Bureau	DARPA	Other DARPA	Other DoD	Sub Total	Mil Per.	Total	Paid From DARPA RDT&E	Paid From Other RDT&E	Paid From Other	Paid From DARPA RDT&E	Paid From Other RDT&E	Paid From Other	Military Personnel Assigned		
Institute for Defense Analyses	81	4,330	---	---	---	4,330	---	4,330	46	---	---	---	---	---	---	---	46
	82	5,100	---	---	---	5,100	---	5,100	53	---	---	---	---	---	---	---	53
	83	5,800	---	---	---	5,800	---	5,800	58	---	---	---	---	---	---	---	58
	84	6,000	---	---	---	6,000	---	6,000	58	---	---	---	---	---	---	---	58
Lincoln Laboratory	81	15,060	---	---	---	15,060	---	15,060	146	---	---	---	---	---	---	---	146
	82	19,350	---	---	---	19,350	---	19,350	181	---	---	---	---	---	---	---	181
	83	18,600	---	---	---	18,600	---	18,600	169	---	---	---	---	---	---	---	169
	84	15,225	---	---	---	15,225	---	15,225	134	---	---	---	---	---	---	---	134
MITRE Corporation	81	1,356	---	---	---	1,356	---	1,356	15	---	---	---	---	---	---	---	15
	82	2,166	---	---	---	2,166	---	2,166	22	---	---	---	---	---	---	---	22
	83	2,520	---	---	---	2,520	---	2,520	24	---	---	---	---	---	---	---	24
	84	2,800	---	---	---	2,800	---	2,800	25	---	---	---	---	---	---	---	25
Aerospace Corporation	81	5,453	---	---	---	5,453	---	5,453	45	---	---	---	---	---	---	---	45
	82	8,055	---	---	---	8,055	---	8,055	61	---	---	---	---	---	---	---	61
	83	8,810	---	---	---	8,810	---	8,810	64	---	---	---	---	---	---	---	64
	84	9,480	---	---	---	9,480	---	9,480	66	---	---	---	---	---	---	---	66

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
DETAIL BY BUDGET ACTIVITY
(\$ in Thousands)

<u>Element Code</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Descriptive Summary Page Numbers</u>
1.	<u>Technology Base</u>					
6.1	<u>Research</u>					
61101E	Defense Research Sciences	\$101,014	\$ 91,400	\$112,100	\$145,000	37
6.2	<u>Exploratory Development</u>					
62101E	Technical Studies	3,145	3,000	3,300	3,600	87
62301E	Strategic Technology	125,354	148,631	151,900	160,000	93
62702E	Tactical Technology	84,348	84,715	103,900	139,700	153
62707E	Particle Beam Technology	--	32,500	31,000	31,000	187
62708E	Integrated Command and Control Technology	32,752	41,100	45,300	49,300	195
62711E	Experimental Evaluation of Major Innovative Technologies	199,449	237,040	268,500	375,554	216
62712E	Materials Processing Technology	11,977	13,300	15,400	19,300	267
62714E	Nuclear Monitoring	15,068	16,800	17,300	22,500	279
6.	<u>Defense-Wide Mission Support</u>					
6.5	<u>Defense-Wide Mission Support</u>					
65898E	Management Hdqtrs (R&D)	<u>7,077</u>	<u>7,776</u>	<u>8,100</u>	<u>8,200</u>	293
	TOTAL DARPA	\$580,184	\$676,262	\$756,800	\$954,154	

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101E
DoD Mission Area: 530

Title: Defense Research Sciences
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in Thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		\$101,014	\$ 91,400	\$112,100	\$145,000	Continuing	N/A
Materials Sciences							
MS-1	Advanced Systems Materials	9,712	11,603	14,775	18,300	Continuing	N/A
MS-2	Electronic and Optical Devices and Materials	14,093	19,092	19,975	24,500	Continuing	N/A
Systems Research							
DRH-1	Systems Sciences	9,973	13,305	15,800	21,400	Continuing	N/A
Computer and Communications Sciences							
CCS-1	Intelligent Systems	14,029	14,200	14,700	19,400	Continuing	N/A
CCS-2	Advanced Digital Structures and Network Concepts	13,875	16,275	21,700	25,600	Continuing	N/A
CCS-3	Modernization Technology	-0-	5,425	5,400	10,000	Continuing	N/A
Tactical Technology Research							

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101E
DoD Mission Area: 530

Title: Defense Research Sciences
Budget Activity: 1. Technology Base

UDR-1	Unconventional Detection Research	3,378	7,050	14,500	18,800	Continuing	N/A
DRT-1	Target Penetration Research	845	2,500	3,300	4,000	Continuing	N/A
Strategic Technology Research							
DRB-1	Charged Particle Beam	33,306	-0-*	-0-*	-0-*	-0-*	68,556
Geophysical Research		1,803	1,950	1,950	3,000	Continuing	N/A

*Transferred to PE 62707E beginning in FY 1982

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

Materials Sciences. This project explores new materials, processing, structures, and device concepts, and demonstrates innovative solutions for overcoming materials related limitations or barriers to advancements in: MS-1 -- advanced bearings and lubricants; new material technology concepts; rapid-solidification technology; improved propulsion engine materials; MS-2 -- high performance monolithic microelectronic and microwave circuits; electro-optical sensors; optical components for communications systems; and special electronic devices and materials for DoD applications.

Systems Sciences. The goal of this project is to develop system sciences to aid defense decision makers through the development of improved man-machine systems and monitoring technology. These will lead to improved effectiveness of Armed Forces personnel in accomplishing their mission responsibilities under a full range of military conditions and operations. This project has been organized to focus on improved command and control and intelligence capabilities; technology for the production of command and control and other software systems; systems for land-based travel; computer-based training technology; and ultra-sensitive chemical monitoring utilizing monoclonal antibodies.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101E
DoD Mission Area: 530

Title: Defense Research Sciences
Budget Activity: 1. Technology Base

Computer and Communications Sciences. This program supports basic research in information processing and computer communication technology to provide a technological base for the development of future intelligent, network-based, military systems. The focus is on basic concept development, and includes the development and exploitation of intelligent systems, innovative computer and network architectures and Very Large Scale Integration (VLSI) architecture and design. A modernization technology effort was initiated in FY 1982 providing experimental computer resources to improve research productivity at the forefront of computer science.

Tactical Technology Research. Activities in the Unconventional Detection Research project are directed towards a determination of the operational potential of detecting submarines by a variety of non-acoustic technologies. The project involves analytic and experimental studies to investigate such detection mechanisms

indications of Motivation for the current efforts are continued

The Target Penetration Research project was established in early FY 1981 in the Tactical Technology Office to address fundamental issues in shock-wave chemistry, synthesis of advanced materials by shock and combustion wave techniques, consolidation of advanced materials by dynamic techniques,

In late FY 1981, this program and the cognizant program manager were transferred from the Tactical Technology Office (TTO) to the Material Sciences Division (MSD) of the Defense Sciences Office to maximize the synergy between applied mechanics and materials science of this program and the other activities of MSD. Coordination of these programs between the Tactical Technology and Defense Sciences Offices is maintained on a continuous basis.

C. BASIS FOR FY 1983 RDT&E REQUEST:

Materials Sciences. In MS-1 the planned increase in funding will be used to accelerate the exploitation of rapid solidification technology to obtain new, high performance alloys for structure and propulsion system components; to continue the demonstration of advanced, solid lubricated bearings for future cruise missile engines; and to continue research on carbon-carbon materials for use at 3500° F for more efficient engines. Other objectives

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101E
DoD Mission Area: 530

Title: Defense Research Sciences
Budget Activity: 1. Technology Base

include: exploration of new crystal growth processing; expansion of research efforts on non-conventional consolidation methods for rapidly solidified alloy powder; research on new elastomers for liner materials in Pershing II rocket motors; development of thermotropic materials for various applications; and continued efforts on a coordinated theory to explain the enhanced properties for rapidly solidified alloys. In MS-2 the planned increase will accelerate new monolithic millimeter wave integrated circuit STET optical signal processing and heterostructure devices research for ultrahigh frequency and infrared sensor applications. Continuing research efforts include: novel materials growth and device structure concepts, and submicron feature processing techniques for digital and microwave integrated circuits based on silicon and III-V compound semiconductors; growth, processing, and characterization of infrared focal plane array materials; analog signal processing structures; electronic polymers; low-loss fibers and fiber-optic sensor systems; frequency agile laser materials; and large optics materials for space systems.

System Sciences. The requested increase is for technology transfer of previous developments in this area, completion of working prototypes scheduled for test and evaluation, and the development of new and required capabilities. These include: transfer of the distributed, low bandwidth, virtual space teleconferencing technology to an Intelligence Community-wide application; development of new low cost teleconferencing architectures and feasibility studies of their application to the tactical domain and large group technology; completion of the design of a color, half-tone codec for teleconferencing; demonstration of the algorithms developed for high resolution synthetic aperture radar image analysis; completion of techniques for dynamic graphics, automatic typography, and automatic software hierarchies to aid software production; completion of the components of an adaptive suspension vehicle including a storage energy unit, hydraulics, laser range finder, hierarchical control algorithms; completion of a digital optical disk authoring station and premastering capability; laboratory demonstration of the components of a ultra-sensitive chemical detection system; completion of algorithms and software for incorporating reactive opponents in related command and control training simulators, including audio and visual display techniques; extension of this command and control training technology to large scale networks, including shaping algorithms and exercisers; concept demonstration of technology for producing fractal-based displays.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101E
DoD Mission Area: 530

Title: Defense Research Sciences
Budget Activity: 1. Technology Base

Computer and Communications Sciences. The Intelligent Systems project supports basic research in machine intelligence and concept demonstrations of systems which exhibit intelligent behavior in defense related tasks. In FY 1983, research in machine intelligence should develop ways for computers to acquire large bodies of specialized knowledge and efficiently bring that knowledge to bear on the complex and dynamic problems of situation assessment, information retrieval, and planning and control in the Command/Control environment. Image understanding research will continue to develop computer techniques for extracting relevant information from photographic imagery, and is expected to automate many aspects of the personnel-intensive tasks associated with image interpretation and cartography. Work in knowledge-based processing will attempt to develop a machine representation and organization of data to support automatic deduction of answers implied by the database contents, but not directly stored in it. Success in this effort will provide a flexibility to cope rapidly with unanticipated queries not possible with current data management systems.

The Advanced Digital Structures and Network Concepts project provides the technology base for dealing with complex and innovative computer and network architectures that will be needed in future military systems. In FY 1983, machine intelligence techniques will be used extensively to support the design, operation and usability of these systems. Concepts for novel computing architectures will be explored. Work will continue on the development of design methodologies, design tools and innovative architectures to use effectively VLSI technology in future military systems. If successful, this program will lead to a major reduction in both the time and cost of designing integrated electronics for major DoD systems while at the same time significantly increasing system capability. Other efforts in this project will address basic research issues in interoperability, reliability and performance of dissimilar, interconnected networks and computer systems. Emphasis will be placed on the development of concepts for dynamic network adaption in the presence of hostile conditions, traffic loads during crisis conditions. Natural and easy-to-learn techniques to access and utilize the resources of highly complex, distributed systems will be developed. The increased funding in FY 1983 includes \$2.0M for VLSI Systems research which will address the development of multiple-chip VLSI systems and wafer scale integration.

The Modernization Technology project is providing experimental computer resources to key university research laboratories. It was created during FY 1982 by reducing the level of effort in the Intelligent Systems project. In FY 1983, the resource modernization program will be continued, and technology for increasing defense

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101E
DoD Mission Area: 530

Title: Defense Research Sciences
Budget Activity: 1. Technology Base

productivity will be explored including the control of advanced manipulators and understanding of 3-D scenes by computer.

Tactical Technology Research. The goals and thrust of the Unconventional Detection Research project remain unaltered with continued priority being placed on detection mechanisms. Emphasis will be placed on the use of for the detection of submarine-

At-sea experimentation will focus on the nature of background interference signals

Successful at-sea background measurement data will allow development of detection algorithms and a firm assessment as to whether signal detection is possible with state-of-the-art sensors.

In FY 1983 the Target Penetration Research project will

shock and combustion wave
techniques to synthesize and consolidate materials for DoD application. The potential impact of these activities will be to create a scientific and engineering understanding of new technologies which will be required for the exploratory developmental demonstration of

dynamically synthesizing and consolidating ceramics for use in a variety of DoD applications where advanced materials are required for use in high temperature and/or high stress environments.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101E
DoD Mission Area: 530

Title: Defense Research Sciences
Budget Activity: 1. Technology Base

Materials Sciences. All efforts on large optics, fiber optics and electronic materials have been transferred to MS-2 from MS-1. All research on current collection and cruise missile bearings will be terminated in FY 1982. The Dual Alloy Radial Turbine concept demonstration has also been transferred to program element 62712E. The efforts on the rapidly-solidified aluminum alloys for aircraft structures and the particulate reinforcement of aluminum alloys will be completed in FY 1982. Continued expansion of Rapid Solidification Technology will occur in FY 1983, with emphasis on dynamic compaction and plasma deposition for alloy consolidation. Other changes are new milestones. In MS-2, effort will expand into new program areas; millimeter wave frequency monolithic integrated circuits, heterostructure devices, and optical signal processing. Solid state neutron detector program is delayed pending final FY 1982 budget passage. Fiber optic sensor system is transferred to Navy and DARPA's Tactical Technology Office for application demonstrations; new fiber sensor device concepts will be explored. Effort in submicron feature device and process research, growth and processing of large mercury cadmium telluride crystals for infrared focal plane sensors, and in low loss fibers will continue. Milestones given in the FY 1982 Descriptive Summaries were met or are on schedule except as follows: solid state thermal neutron detector feasibility delayed to late FY 1984 due to late program start; and 10,000 gate gallium arsenide (GaAs) integrated logic circuit changed to 4,096 bit memory circuit in support of new thrust in GaAs radiation hard microelectronics.

Systems Sciences. No significant changes.

Computer and Communications Sciences. The only significant changes are milestone changes.

Tactical Technology Research. The funding decrease for FY 1982 in the Unconventional Detection Research project has resulted from pushing major experimental efforts into FY 1983 to allow for further analytical work and to accommodate delays in sensor development. Program milestone changes reflect this fact. In the Target Penetration Research project new analytical and experimental efforts are being introduced

Based on the
successful synthesis augmented efforts are being conducted to
synthesize and consolidate ceramics. No significant changes in the milestones reported in the FY 1982
Congressional/Budget submission have occurred.

2. OTHER APPROPRIATION FUNDS: None

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MS-1
Program Element: #61101E
DoD Mission Area: 530

Title: Advanced Systems Materials
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The objectives are to explore new materials concepts, and seek solutions to materials limitations which prevent further advances in power sources and in advanced tactical and strategic systems. The materials programs in support of power systems are concentrated in high-power-density electric machines, in higher-performance turbine engines, and in rocket motor materials. If advanced solid brushes can be developed, new applications of segmented-magnet machines will be feasible. These include more compact, lower-weight, marine power drives and electrical tank transmission drives which have less inertia, higher efficiency, and lower infrared signature than mechanical transmissions. Solid-lubricated, roller element bearings offer the potential of maintenance-free operation in extreme environment where liquid, organic lubricants are limited by high or low temperatures, oxidation and corrosion (long storage times), and radiation-induced breakdown. Solid-lubricated main engine bearings for cruise missile engines would offer increased performance (by permitting higher operating temperatures), reduced engine weight and volume (through removal of the liquid lubrication system), and significantly reduce maintenance requirements. The full exploitation of rapid solidification powder technology will make possible a 300°C increase in operating temperature limits for turbine-blades, hence higher specific thrust and lower specific fuel consumption for advanced cruise missile and tactical aircraft engines. New aluminum alloys emerging from this technology will challenge higher-cost titanium alloys and composite materials for achieving weight, cost, and fuel reductions in advanced aircraft and missiles. Metal-matrix composite research is addressing particulate reinforcement for achieving high -stiffness and high-strength aluminum alloys, ion plating as a method for making wide tape composite precursor, and new methods for achieving ultra-high modulus graphite fibers (120 million psi) that could yield zero coefficient of thermal expansion composites at practical fiber contents. New elastomers and winding procedures are being researched to increase the range and reduce the cost of Pershing II rocket motors. Materials programs in support of strategic systems are focused on advanced carbon-based composites for cruise missile engines having very high efficiency.
- G. RELATED ACTIVITIES: Advanced bearing materials efforts are being coordinated by the Air Force Wright Aeronautical Laboratories. DARPA programs in metal matrix composites and Rapid Solidification Technology are coordinated with other service efforts through joint steering committees. The rocket motor elastomers program is coordinated with the Army Missile Command.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MS-1
Program Element: #61101E
DoD Mission Area: 530

Title: Advanced Systems Materials
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

H. **WORK PERFORMED BY:** Effort is distributed among performers as follows: 65% industry, 29% universities and 6% in-house government laboratories. The ten top performers are: Marko Materials, Incorporated, Watertown, Massachusetts; DWA Composite Specialties, Inc., Chatsworth, California; Westinghouse Electric Company, Pittsburgh, Pennsylvania; Lockheed, Palo Alto, California; University of Michigan, Ann Arbor, Michigan; Stanford University, Palo Alto, California; University of California, Davis, California; and Northeastern University, Boston, Massachusetts. In-house laboratory efforts are performed at the Naval Research Laboratory, Washington, D. C.; Air Force Wright Aeronautical Laboratories/Materials Laboratory, Dayton, Ohio; and the National Bureau of Standards, Gaithersburg, Maryland.

I. **PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. **FY 1981 and Prior Accomplishments:** A twenty foot long aluminum-graphite metal matrix composite furlable antenna rib was fabricated, and fabrication of a similar component made from graphite-magnesium was undertaken. These components have demonstrated the feasibility of using metal matrix composites for satellite antenna structures which are lighter than would be possible with other suitable materials, and will minimize antenna distortion caused by uneven component heating. The result of this will be a large increase in antenna signal-to-noise ratio. Effort was transferred to program element 62712E for fabrication and test of a complete antenna structure. Development of a new aluminum alloy based on rapidly solidified powder technology has demonstrated that a 30% increase in specific stiffness (elastic modulus divided by density) can be achieved, while retaining acceptable levels of ductility. This achievement translates directly into corresponding weight savings for a wide-variety of stiffness critical defense weapon system components. A high temperature capability aluminum alloy prepared by rapid solidification rate powder processing demonstrated acceptable strength and ductility at temperatures up to 350°C. Part-weight savings of 31% compared to titanium and 61% compared to steel were achieved for gas turbine engine stator vane components. Rapid solidification processing of bearing steels has yielded material which should lead to longer life, more reliable bearings.

2. **FY 1982 Program and FY 1983/FY 1984 Planned Programs:** New efforts in the area of Rapid Solidification Technology will include scale up of a new rapid solidification method for producing powder for the study of new steel compositions with high temperature capability, test the feasibility of plasma spraying to form new higher

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MS-1
 Program Element: #61101E
 DoD Mission Area: 530

Title: Advanced Systems Materials
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

capability turbine engine combustors and study of dynamic and other unusual compaction methods for consolidating powders into useful, near-net shapes. New metal matrix composite effort will explore the use of casting methods to make composites reinforced with continuous silicon carbide filament. Solid lubricated rolling element bearings will be operated in cruise missile engine test stands to determine the technical feasibility of developing an all solid lubricated cruise missile engine. A carbon-carbon disk will be spun at 3500°F for 5 hours at a tipspeed of 2,000 fps. To grown through FY 1984 in order to adequately explore the potential of this new technology.

3. Program to Completion: Efforts in Rapid Solidification will continue (to grow through FY 1984 in order to adequately explore the potential of this new technology). The bearings program will be terminated in FY 1984 when a decision will be made on its applicability to cruise missile engines.

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes for Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1981	Mid FY 1982	Demonstrate large diameter spaceborne carbon-carbon mirror substrate technology.	Problems in supply of materials
--	End FY 1982	Demonstrate higher structural efficiency aluminum alloys from rapid solidification processing through extensive engineering property characterization.	New Milestone.
Mid FY 1983	Mid FY 1983	Demonstrate operation of a solid lubricated cruise missile main engine bearing operating at 250°C for 25 hours.	New milestone

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MS-1
 Program Element: #61101E
 DoD Mission Area: 530

Title: Advanced Systems Materials
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Advanced Systems Materials	9,712	11,603	14,775	18,300

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MS-2
Program Element: #61101E
DoD Mission Area: 530

Title: Electronic and Optical Devices and Materials
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to explore and demonstrate device, material, and material processing concepts which will provide: (1) new technical options for implementation of future electronic and optical systems and functions; and (2) substantial increases in performance, reliability, and availability of electronic and optical components and monolithic, high functional throughput circuits at reduced cost per function. Specific areas of electronic device and materials research include revolutionary new approaches to produce large area infrared sensor materials and solid state thermal neutron detector materials and devices for strategic and tactical acquisition and surveillance systems; innovative processes, device design concepts, and computer-based process design aids for the timely, affordable design and fabrication of submicron feature size integrated circuits; radiation induced "soft errors" in microelectronic circuits; low power, radiation tolerant compound semiconductor monolithic integrated circuits for high speed digital logic and microwave and millimeter wave transmission/reception; analog signal processing structures; and electronic polymers. Specific areas of optical materials and components research include: ultra-low loss fiber-optic waveguides for long distance, secure communications; fiber-optic sensors which promise to revolutionize Anti-Submarine Warfare technology; large optics structures for space applications; components for blue green laser communications; optical signal processing; and innovative combat designation and viewing systems.
- G. RELATED ACTIVITIES: The Services have programs developing specific infrared sensor devices. The DARPA program is focused principally on materials growth, processing, and characterization of mercury cadmium telluride (HgCdTe) for hybrid and monolithic infrared sensor arrays. Specific coordination is maintained with the Army's new initiative in HgCdTe sensor yield and manufacturing. The Services have initiated, under a coordinated effort through the Under Secretary of Defense for Research and Engineering (USDR&E), exploratory and advanced development efforts in Very-High-Speed-Integrated-Circuits (VHSIC) based on existing silicon technology. The research effort in submicron device and materials technology complements the USDR&E program by addressing long range problems in design and fabrication of materials and devices that operate at or very near their physical limits. The submicron devices and materials research will have direct impact on the VHSIC effort in the 1983-1985 period through demonstration and subsequent transfer of new semiconductor materials, processes, and device concepts leading to fabrication of circuits having unprecedented computing/data processing power. A number of efforts are funded jointly with the Air Force, Navy, and Army Offices of Research, and the Naval Electronic and Air Systems Commands. Cooperative efforts at universities in submicron structures and crystal growth research are in progress with the National Science Foundation and National Aeronautics and Space Administration.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MS-2
Program Element: #61101E
DoD Mission Area: 530

Title: Electronic and Optical Devices and Materials
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

H. WORK PERFORMED BY: Approximately 48% of this work is performed by industry, 35% by universities, 16% by government laboratories, and 1% by FCRCs. The top industrial performers include: Rockwell International Science Center, Thousand Oaks, California; Honeywell Research Center, Bloomington, Minnesota; Texas Instrument, Dallas, Texas; McDonnell Douglas, Huntington Beach, California; and International Business Machines, Yorktown Heights, New York. The top university performers are: Stanford University, Palo Alto, California; Massachusetts Institute of Technology, Cambridge, Massachusetts; University of Pennsylvania, Philadelphia, Pennsylvania; and University of California, Berkeley, California. The Naval Research Laboratory, Washington, D.C. is our in-house performer and Lincoln Laboratory, Bedford, Massachusetts is our FCRC performer.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Charge coupled devices on mercury cadmium telluride (HgCdTe) infrared sensor material were demonstrated, thus promising the realization of more than an order of magnitude increase in the number of detectors in infrared detector arrays on a single chip of detector material (DARPA/Navy funding). Major advances in techniques to characterize HgCdTe material were developed and applied to industrial R&D programs. The second generation version of the computer-based process simulation program for integrated circuit fabrication was issued to over 200 users in industry, government laboratories, and universities; its capabilities substantially exceed that of any process simulation program previously available to DoD and its integrated circuit vendors; it is also gaining use in the commercial sector. Experimental studies led to the formation of an entirely new theory for the formation of electrically active interface defects which form when metal layers are placed on clean semiconductor surfaces. A new class of high sensitivity electron beam resists based on diacetylene polymers was discovered. The planar, ion-implanted, gallium arsenide (GaAs) high speed integrated circuit process pioneered by DARPA has established the technical direction of industrial research throughout the country aimed at GaAs digital integrated circuitry and monolithic microwave circuit fabrication, and has led to the possibility of a highly radiation tolerant microelectronics technology. GaAs Large Scale Integrated (LSI) Circuit technology has been demonstrated by fabricating a monolithic 8 by 8 digital multiplier. A new GaAs bipolar technology using inverted hetero-junction GaAlAs-on-GaAs emitters has emerged to make GaAs gate array technology promising. The successful development of silicon-on insulator technology is the first step in ultimately achieving a three dimensional monolithic semiconductor electronic technology. Metal and stress-tailored ceramic coatings suitable for protecting

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DoD Mission Area: 530

Title: Electronic and Optical Devices and Materials
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

and strengthening optical fibers from surface flaws were developed and demonstrated, thus furthering the feasibility of using optical fiber waveguides in military systems. Major advances in acoustic and magnetic sensors were achieved using optical fiber technology.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The exploration of new techniques to grow, process, and characterize large-area, mercury cadmium telluride (HgCdTe) detector crystals is demonstrating the feasibility of liquid phase, vapor exchange, and laser assisted epitaxy approaches, and the utility of employing state-of-the-art processing techniques (ion implants, laser annealing) established in silicon microcircuit technology. A largely university-based research program in characterization of HgCdTe is providing important new physical insights into this material. Feasibility of HgCdTe monolithic charge coupled device area array imagers is being extended to larger arrays. Effort on TV resolution infrared focal plane arrays based on Schottky barriers on silicon is continuing. Development of non-linear and electro-optical polymer single crystals has moved from the synthesis and characterization stage into device demonstration for frequency doubling tunable filters, etc. The Submicron Device and Materials Program continues to build on the microelectronic research base established during FY 1975-FY 1980 in the areas of computer aids for process and device modeling, submicron feature processing, and analytical characterization of semiconductor materials and device structures. This effort emphasizes innovative processing techniques for developing novel device structures, submicron size features, and a vertically-integrated (materials science through computer science) fast turn-around microcircuit fabrication methodology to provide performance intensive data/signal processing circuits for future military systems on a timely and affordable basis. Effort is continuing to assess the extent to which military radiation environments will cause "soft error" (computational and memory storage errors) in advanced microelectronic circuits. Research on high-speed, low-power, compound-semiconductor integrated circuits has realized large scale integration (LSI) complexity (greater than 1000 logic gates per circuit) for microwave and communication signal processing functions. A new thrust is under way toward 4096 gate array circuits based on GaAs bipolar devices, and micropower, radiation tolerant 4096 bit random access memory as the base for a radiation hard microelectronics technology for space applications. Initial research on monolithic millimeter wave circuits is beginning. Exploration of the feasibility of forming electro-optical and microwave components on a single compound semiconductor chip to accomplish high data rate communications functions is demonstrating a viable monolithic optical repeater concept. Research in solid state thermal neutron detection is being assessed for an early FY 1983 start. Research on fiber-optic acoustic sensors is

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reaching completion, with transfer to Navy and DARPA/Tactical Technology Office for application demonstrations. New sensor concepts based on optical fiber technology are being explored. New efforts in optical signal processing and large optics materials are beginning, and development of new materials for low-loss optical fibers continues.

In the FY 1983 planned program, increased funding will support expansion of new efforts in millimeter wave monolithic circuits, heterostructure devices and optical signal processing. The submicron feature-size technology program will expand exploration of feasibility of three-dimensional integrated circuit structures. Physical phenomena and manufacturing tolerances which place fundamental limits on the minimum feature size and maximum performance and complexity of submicron digital circuits will be defined both theoretically and experimentally. Research on electro-optical and non-linear optical properties of single crystal polymers will be completed with determination of all pertinent material properties and demonstration of device applications. Exploration of new concepts for growth of highly uniform large semiconductor crystals will be completed, and demonstrated innovations transferred directly to industrial efforts for further development. Gallium arsenide monolithic circuit fabrication techniques will be extended to provide a radiation hard circuit technology for space systems. Efforts in silicon processing, process and device modeling, and characterization will continue based on the wide-ranging importance and acceptance of the current research results.

New process technologies for large-area mercury cadmium telluride crystals will demonstrate feasibility of material larger than five centimeters in diameter, and incorporate advanced processing techniques in the sensor fabrication cycle. Signal processing functions such as storage correlation will be demonstrated using electro-acoustic device technology.

Exploration of electronic applications of polymer fibers and polymer single crystals will continue to transfer new achievements from university to industry for further development. The program exploring new fiber-optic sensor concepts will demonstrate suitable fibers and coating fabrication technologies as needed for presently envisioned applications. Effort on optical signal processing will expand. Ultra-low loss fibers for long range repeaterless communication links will continue in development, and development of components for blue-green laser communications will be completed. New optical materials will be generated to make inexpensive night vision devices, and large space based optics structures.

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In the FY 1984 planned program, research on growth and processing of large area mercury cadmium telluride infrared sensor material will approach completion with successful efforts transferring to Services' exploratory development for scale-up and demonstration of manufacturing utility; efforts on monolithic staring sensor concepts will be expanded. Exploration of new concepts for three dimensional microcircuits will continue, as will characterization and modeling of physical phenomena inherent in fabrication of submicron feature semiconductor devices and circuit processing. Emphasis will be placed on monolithic integration of diverse technologies such as Surface Acoustic Wave (SAW), Charge Transfer Device (CTD), bipolar and Field Effect Transistor (FET) logic to permit each technology to perform those electronic functions for which it is optimum. Research on process techniques and control mechanisms for fast (less than one week) turnaround fabrication of new circuit design concepts will continue. New concepts in compound semiconductor devices and fabrication will be explored, including innovative monolithic uses for the unique electro-optical and microwave device properties of gallium arsenide and closely related materials. Development of materials for miniature designators will be completed. Fiber optic sensor research will transfer to the Navy with the demonstration of technology suitable for applications. Optical fiber technology for ultra-long range communications will transfer to exploratory development; research in problems related to low-loss fibers, such as radiation sensitivity will continue.

3. Program to Completion: Research efforts exploring the feasibility of specific new concepts in devices and materials within the Electronic and Optical Devices and Materials Project generally have a duration of three to six years. New efforts will be expanded in technology applications of monomolecular films, electronic polymers, optical signal processing, and three dimensional circuit structures. The effort in mercury cadmium telluride materials should decrease rapidly after FY 1984, as will efforts in silicon and GaAs digital microcircuitry and processing, thus allowing growth of other efforts. The submicron materials and device physics effort is anticipated to continue to FY 1985 and beyond due to the far-reaching operational significance which accompanies success, and the extreme technical challenge involved. Research in low loss optical fiber materials and new device concepts based on these, and in optical signal processing, will continue beyond FY 1985 due to their emerging importance in secure and other communications. This project is a continuing one because of the importance of electronic and optical devices and materials in accomplishing present and anticipated future DoD missions.

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4. Milestones: The milestones reported in the FY 1982 Descriptive Summary have been completed or are expected to be completed on schedule except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes for Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Late FY 1982	Demonstrate 256 bit gallium arsenide random access memory.	No change.
--	Mid FY 1983	Storage and correlation in electro-acoustic device structure suitable for anti-ship missile imaging radar system.	New Milestone.
--	Late FY 1984	Feasibility of 2" diameter HgCdTe layers on high band gap substrate.	New Milestone.
Late FY 1983	Late FY 1984	Demonstrate feasibility of solid state thermal neutron detectors.	Delayed program start due to FY 1982 budget uncertainties.
Mid FY 1984	Late FY 1984	4,096 gate array gallium arsenide digital integrated circuit.	Goal of 10,000 gate changed to support new thrust toward radiation hard GaAs ICs integrated circuits.
--	Late FY 1984	Computer Aided Design for high speed GaAs Gate arrays.	New Milestone.

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5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Electronic and Optical Devices and Materials.	14,093	19,092	19,975	24,500

DARPA does not receive funding from the Services or other Agencies in support of program efforts under this project. However, about one-third of the effort is closely coordinated with independently-funded efforts supported by the Services and/or other DARPA Offices under joint-program Memoranda of Agreement and other agreements.

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Project: #DRH-1
Program Element: #61101E
DOD Mission Area: 530

Title: System Sciences
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The goal of this project is to develop the system sciences that form the basis for technological aids to augment the performance of Department of Defense decision makers. Command and control problems that are addressed include: information overload, including redundant and ambiguous messages; difficult database searching; poorly presented information; difficulties of group decision making and group communication; poor acceptance of technological aids to decision making; difficulties of complex decision making; excessive cost and high error rate in the construction and design of complex systems, e.g. major software systems for command and control and difficulty in analysis of large numbers of overhead images that are gathered at great cost; control systems for adaptive suspension vehicles; related command and control training technology; and ultra-sensitive chemical monitoring technology.

One technical initiative is command and control information systems. This effort involves: developing a new technological approach for the presentation of geographic imagery to aid in tactical planning and tactical operations, using video disk technology and geometrically distorted oblique overhead imagery to present realistic, perspective, ground level views of terrain and cultural features; the development of a virtual space, low bandwidth, distributed teleconferencing technology; and the development of heuristic and analytic techniques to aid in the increasing problem of high resolution synthetic aperture radar image analysis. To date, the video disk based geographic display technology has provided a capability previously unavailable to mission planners and used in a number of applications. The teleconferencing technology is aimed at the Department of Defense problem of distributed decision making, and in addition to the development of the technology base two particular applications will be met - one for the Air Force and another in the Intelligence Community. Finally, technological capabilities for collection of overhead imagery have far out-stripped our ability to analyze the imagery; this problem is most acute with high resolution synthetic aperture radar imagery and the new techniques are aimed at removing this bottleneck.

A second initiative is specifically aimed at developing a new methodology for the specification, requirements definition, documentation, design, implementation, debugging, maintenance, and management of very large command and control systems. Under development is an interactive graphics system that makes visible to DoD personnel, for the first time, the workings of such systems, displayed at varying levels of detail. Applications include the development of major software systems, e.g., ADA systems; the development of newly emerging very large-scale

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integrated circuits (VLSI); the design of programs for the analysis of technical and surveillance data; and the design of complex strategic and tactical systems. Although the most direct impact of this new technology will be in major cost savings, e.g., billions of dollars a year in software production alone, the major long-term Department of Defense impact will be in improved correctness for complex command and control systems. Failures in such complex systems, e.g., World Wide Military Command and Control System (WWMCCS), that heavily depend on the correctness of very large-scale computer programs can be extremely expensive, if not catastrophic.

A third initiative is in the area of adaptive platforms. This effort will provide new controls and capabilities for land-based travel over previously inaccessible terrain using a new control system that anticipates the future path using a laser range-finder, relieves the operator of responding to the details of that terrain, and adapts the suspension of the land based vehicle to accommodate to the terrain. Preliminary data to date demonstrates major mobility improvements, e.g., a doubling of one maximum speed of travel over rough terrain.

Fourth, an effort is underway to produce a low cost, portable, training simulator technology with associated displays for command and control applications. The technology will make use of newly developed fractal based displays that have been shown in the laboratory to produce imagery 144 times faster than the best prior methods.

Fifth, an ultra-sensitive monitoring technology is being developed using monoclonal antibodies, with applications in both the tactical and strategic arenas, including anti-chemical warfare.

- G. RELATED ACTIVITIES: These efforts are coordinated with Army Research Institute, Battlefield Information Systems Program; Defense Mapping Agency; European/J2 and Department of Army; the Air Force Rome Air Development Center; and Command and Control research with the Marine Corps.
- H. WORK PERFORMED BY: 65% industry and 35% universities. Major performers include Massachusetts Institute of Technology, Cambridge, Massachusetts; Perceptronics, Woodland Hills, California; Computer Corporation of America, Cambridge, Massachusetts; and Decisions and Designs, McLean, Virginia.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

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Title: System Sciences
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Budget Activity: 1. Technology Base

1. FY 1981 and Prior Accomplishments: Techniques have been demonstrated for identifying selected connotations of a neural "language". The result is a new means of man-machine interaction including the capabilities for transmitting commands, connotations, surprise, decision-making, fatigue, boredom, uncertainty, processing load, and spare capacity. The implications of this basic advance have specific Air Force application in the development of flight training, selection of pilots, the design of new aircraft, and general applicability to service training and selection. An algorithm has been developed for the automatic selection and routing of information in a command and control system with an improvement in the signal-noise ratio of approximately a factor of 100. A technique for ultra-rapid text presentation has been demonstrated that can improve the speed of reading command and control methods by a factor of 2 to 4 without a decrease in comprehension. Both the adaptive information system and ultra-rapid reading capability have been transferred to the Marine Corps. A Spatial Database Management System has been demonstrated in a command and control context. A group decision-making system has been developed and tested in various applications, including procurement decision making. The Spatial Database Management System and group decision aid have also been introduced in the Navy and Marine Corps, as well as other application areas. Other accomplishments include: the development of and transfer to the Marine Corps of an improved military typography terminal for command and control message systems; advances in decision theory including validation, problem structuring, and contingency planning; enhancement, testing and evaluation of crisis management systems, including increased crises case selection and description.

Further accomplishments include: development and application of new techniques for improved man-machine relations, improving the acceptance of computer technology; the development of Mailphone, a new electronic mail and telephone communication capability which significantly increases ease of use; the completion of a prototype teleconferencing system designed for National Command Authority use during nuclear crisis which will make possible decision making in a safe and distributed fashion without loss of capability; the development of a new technique for very low bandwidth video transmission (9600 bits/sec) to make possible distributed teleconferencing systems; the completion of a portable, computerized videodisc-based tactical map store incorporating DARPA's novel capability in a fieldable package; and the discovery of a new technique using the Weisstein effect for the significant enhancement of overhead imagery.

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In FY 1981, systems for early warning and monitoring of international and intranational crisis (EWAMS) were completed, as well as the Terrorist Research Analysis Program (TRAP). This will provide major new capabilities for Indications and Warnings in the anti-terrorist arena, and has already been transferred and used by a number of groups. In the area of tactical mapping technology, a production capability was begun for the geometric transformation of oblique overhead images in order to provide ground level views for denied areas for such applications as special operations, special forces, the Rapid Deployment Force, and other tactical uses. Other accomplishments in tactical mapping include combination of photographic and computer-generated imagery in a map-display system and completion of video disk-based geographic display systems in coordination with the Army, Defense Nuclear Agency, Department of Energy, and the Department of State. Finally, four prototype systems were completed: the teleconferencing system mentioned above; a Spatial Database Management System (SDMS) with special capabilities for displaying and retrieving time-varying command and control data which will be installed on the nuclear aircraft carrier Carl Vinson; a prototype adaptive Spatial Database Management System that will provide a new capability for automatically restructuring command/control and intelligence data bases to accommodate user desires and anticipated needs; and the development of a computerized aid for decision makers to help in making choices involving large numbers of options and variables, initially for technology transfer to the Rapid Deployment Force.

Further FY 1981 accomplishments include completion of an adaptive suspension unit for vehicles for land-based travel that use one tenth the energy of previous designs; for such vehicles, completion of algorithms for a control hierarchy, and algorithms for two dimensional balance; research on software hierarchies and software graphics, that will for the first time give the programmers and other DoD personnel the opportunity to visualize graphically the running of large scale programs leading to reduced production costs, as well as improved accuracy of operation of large scale command and control systems; and initiation of technology for command and control team training, including a provision for reactive opponents and fractal-based displays.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In FY 1982 the low bandwidth virtual space teleconferencing system will undergo initial test and evaluation and is expected to have major impact on the quality of decision making during national crises. Current teleconferencing systems are limited either by requiring very large bandwidth that will not be available during national nuclear crises or by so degrading the quality of distributed meetings that effective decision making is impossible. By using newly developed techniques

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for low bandwidth video, the new system will allow effectively distributed decision making in a realistically low bandwidth environment. The Air Force Personnel Command has selected this technology for their applications and is developing a system that will be completed in FY 1982.

In FY 1982, work will be completed on the anti-terrorist system TARGET with transfer to a Department of Defense customer. Geographic display systems will be developed with several customers, including JCS, DIA, USN, TAC, and an intelligence agency. The system for the production of ground level images by the geometric distortion of oblique overhead imagery will be developed further to allow, for the first time, effective tactical map displays of denied areas, particularly economical through the use of currently available overhead resources. Further, this technology will be expanded to allow essentially instantaneous updating using electronic materials to supplement video disks.

In the area of adaptive platforms for land-based travel, work has begun on the laser range-finder technology, hydraulic technology, and energy-storage technology required for successful prototype completion. In addition, dynamic balance heuristics will be extended to three dimensions. In the area of command and control system software, efforts on dynamic graphics and typography will be initiated.

As an aid to the analysis of high resolution synthetic aperture radar imagery, algorithms for relating image characteristics to scatterer characteristics, expert system heuristics, and feature extraction techniques will be completed in FY 1982.

Using monoclonal antibodies for specificity and florescent vesicles for sensitivity, monitoring technology applicable to anti-chemical warfare will be developed. These same technologies are applicable to a wide range of strategic and tactical detection problems. Command and control training technology will include completion of the team training technology, refinement of the algorithms for reactive opponents, and initiation of new audio and visual techniques for improving the realism of presented displays. Algorithms will be completed for fractal-based display presentation.

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In FY 1983, work will be completed on the design of low bandwidth, color, halftone codec for virtual space teleconferencing applications, and this design will be implemented using very large scale integrated circuitry, beginning in FY 1984. The current low bandwidth, virtual space distributed training technology will be transferred to an Intelligence Community application involving the crisis watch centers. Further, the technology will be expanded to include large group teleconferencing. New architectures for low cost teleconferencing will be developed to make feasible applications in the tactical domain, such as distributed command centers. In FY 1983 the demonstration of the algorithm for high resolution synthetic aperture radar image analysis will be completed, incorporating the FY 1982 results. In the area of command and control systems software production, a programmer/debugger/maintainer work station incorporating dynamic graphics, automatic typography and automatic software hierarchies will be completed in late FY 1983. Also in late FY 1983, an adaptive suspension vehicle incorporating prior work in energy storage systems, hydraulics, laser rangefinders, adaptive suspensions, and control algorithms will be completed and demonstrated. This technology will have a major impact on land mobility.

In FY 1983, a laboratory demonstration of the components of an ultra-sensitive chemical detection system will be completed. This work will be followed, in FY 1984, with a concept demonstration system for anti-chemical warfare application using monoclonal antibodies associated with fluorescent vesicles; other technologies using biochemical methods for chemical detection will be developed. In the area of command and control training technology, in FY 1983, work will be completed on reactive opponents and audio (binaural) and video display techniques. The major efforts will be in the expansion of the technology to large scale networking to supplement, for example, major international exercises such as Reforger; and the development of fundamental new algorithms based on learning theory for improving training, with associated exercisers. Further, an array processor-based fractal display technique will be demonstrated.

3. Program to Completion: There is a continuing requirement for improving the effectiveness of Armed Forces personnel in mission responsibilities. Future program content will be determined by research results, technology options and operational problems arising in this critical area.

4. Milestones: Milestones cited in the FY 1982 Descriptive Summaries with completion dates through mid-FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Late FY 1982	Initial test of distributed group decision making and teleconferencing.	
Late FY 1982	Late FY 1982	Distributed, low bandwidth teleconferencing system.	
--	Late FY 1983	Design of 50KB color codec.	New milestone
--	Late FY 1983	Demonstration of high resolution SAR image analysis algorithm.	New milestone

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
System Sciences	9,973	13,305	15,800	21,400

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Object: #CCS-1
Program Element: #61101E
DoD Mission Area: 530

Title: Intelligent Systems
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

(U) DETAILED BACKGROUND AND DESCRIPTION: The Intelligent Systems project combines fundamental investigations into the limits of the digital computer's capability for intelligent processing of information, with concept demonstrations in selected areas of military relevance. The goal is to make it possible for computers to assist and/or relieve military personnel in complex or routine decision-making tasks which are information or personnel intensive, tedious, dangerous, or in situations which are rapidly changing. This project includes work in Image Understanding and Artificial Intelligence (AI) Research and Applications. In the area of Image Understanding, computer techniques are being developed for extracting information from photographic and other two-dimensional imagery with the primary goals of providing intelligent assistance for image interpretation and intelligent navigation and guidance control through the rapid use of imagery in the tactical environment. Techniques developed in this program will be integrated and implemented in a cartographic workstation being developed in conjunction with DMA. AI Research is exploring new ways to represent and use knowledge in computers, in order to perform tasks that require symbolic reasoning of sufficient complexity that one would ascribe intelligence to a human who performed them. Work in AI Applications has the objective of developing demonstration models and systems that reflect intelligent behavior in carrying out Defense related tasks. A major effort is underway to integrate AI applications such as information presentation and natural language front ends to command and control (2) systems.

(U) Continuing efforts include the development of intelligent aids for tactical air battle management, adaptive control of multiple sensors in electronic warfare (EW) systems, intelligent database access mechanisms, signal understanding and cooperative problem solving in a distributed computer environment, intelligent sensor architectures, and synthesis of computer algorithms from high level specifications. Work in knowledge base processing is focused on the development of production rule systems, and on extending the flexible information representation, storage and retrieval techniques that have been demonstrated in prototype intelligent systems to make these techniques applicable to the management of large command and control databases. Concepts are being developed for systems which accept natural inputs, including English text, tables and graphics, which incorporate rules for deducing answers that are implied by the database contents but not directly stored and which can rapidly reorganize internal storage structures to meet the urgent needs of decision makers. New efforts have begun in the areas of strategic planning and replanning, specialized memory architectures for extremely fast knowledge retrieval, and an expert system to assist in developing carrier aircraft launch and recovery plans (AIRPLAN).

(U) RELATED ACTIVITIES: The National Science Foundation (NSF), the National Institute of Health (NIH), the National Aeronautics and Space Administration (NASA), the Office of Naval Research (ONR) and the Naval Research Laboratory (NRL)

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support artificial intelligence research. These efforts address industrial automation, analytical chemistry, immunology, deep-space and undersea probes, and management decision aids. ONR, the Air Force Avionics Laboratory (AFAL) and NSF sponsor related research in image understanding. Techniques developed in this program have widespread applicability throughout the Defense Department. Close coordination with prospective users is maintained through workshops, site visits, the choice of contracting agents, and joint programs. Examples of joint programs include the Image Understanding Testbed and Natural Language Database Interface work being performed in conjunction with the Defense Mapping Agency.

(U) WORK PERFORMED BY: 47% Industry, 49% University, 4% In-house. Major performers are SRI International, Menlo Park, CA; Kestrel Institute, Palo Alto, CA; Rand Corporation, Santa Monica, CA; Bolt Beranek and Newman, Cambridge, MA; Massachusetts Institute of Technology, Cambridge, MA; Carnegie Mellon University, Pittsburgh, PA; Stanford University, Palo Alto, CA; University of Southern California, Los Angeles, CA; Yale University, New Haven, CT; and University of Rochester, Rochester, NY.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: Symbolic representation and identification techniques were developed and applied to cartographic feature extraction problems, and image understanding algorithms for deriving 3-D information from a moving source were implemented. Algorithms for image segmentation and road location were implemented in the Cartographic Workstation. Specialized hardware to perform real-time depth mapping has been developed and an automated system that uses expert knowledge and collateral sensor data to identify specific features in an arbitrary aerial photograph has been demonstrated. Knowledge engineering techniques that can allocate resources and interpret sensor data in an automated multi-sensor environment were demonstrated, and concepts for automated tactical air battle management were developed.

(U) Advances in formal reasoning were made and a very high level, rule-based language for implementing expert systems was developed (ROSIE). Production rules and semantic networks have been incorporated in systems for signal understanding, situation assessment tasks, planning and control in applications requiring extensive judgmental knowledge, and reasoning under conditions of uncertainty. New technologies for large knowledge bases were implemented that will permit presentation of information not specifically requested and maintenance of each users view of the database tolerant access.

(U) Application of AI techniques to natural language understanding, data intensive planning, automated synthesis of

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algorithms, and distributed problem solving were carried out. The TEAM system, which provides a portable, natural language access to distributed data bases, has been interfaced with two different databases and has demonstrated significant improvements over highly stylized and inflexible data base access languages. A data intensive planning system has been specified, and initial implementation on a personal workstation has begun. The first phase of an intelligent display-based information presentation system which incorporates a natural language interface has been developed. Paradigms and algorithms for cooperative, distributed problem solving methods that will be applicable to future intelligent distributed applications in wargaming, command and control, and planning have been developed.

2. (U) FY 1982 Program and FY 1983/FY 1984 Planned Programs: During FY 1982, Image Understanding research is extending its domain to integrate data from multiple sources such as optical images, radar, forward looking infrared radar (FLIR) and text in order to exploit all available sources of information. Applications of image understanding techniques to passive navigation and tactical target cueing are being investigated and work is continuing to transfer new technology to the Cartographic Workstation. AI research will continue to investigate new techniques for symbolic problem solving in a distributed environment, including computation/communication tradeoff strategies, dealing with incomplete and/or inaccurate information at any single processor and allocation of tasks without centralized control.

(U) Advanced knowledge acquisition techniques are being applied to the creation and dynamic modification of data bases, with automatic consistency maintenance. Research in natural language understanding is focusing on knowledge base interfaces, extensions of semantic networks, understanding context of discourse, and user definition of system capabilities. An expert system (AIRPLAN) is being developed to assist in the planning of aircraft launch and recovery operations from a carrier, and will be demonstrated on an aircraft carrier. In conjunction with the Very Large Scale Integration research effort, AI techniques are being developed to cope with the complexities of VLSI circuit design and layout, and in novel VLSI implementations of multiprocessor systems for efficient parallel symbolic problem solving. Advanced memory technologies are being developed for rapid recall of "knowledge". The ROSIE system is being extended to operate over a local network in a distributed computational environment. An "expert" system for cartographic feature identification, a prototype expert assistant for tactical targeting, and an advanced information presentation system are scheduled for demonstration. The data intensive planning system is being implemented on a personal workstation and integrated into a local network environment.

(U) During FY 1983 fundamental research on image understanding will continue with emphasis on tracking of mobile targets

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Title: Defense Research Sciences
Budget Activity: 1. Technology Base

and application to autonomous navigation. Algorithms for symbolic image representation, 3-D mapping, and feature identification will be added to the Cartographic Workstation. Development of expert systems to demonstrate the feasibility of automating the photointerpretation task will also be emphasized. AIRPLAN will be refined and extended as experience is gained from actual air operations. AI research will continue to develop new techniques that permit users to specify what task they wish a computer system to accomplish rather than how the task is to be performed. The acquisition, representation and utilization of large bodies of knowledge for expert systems will be emphasized. ROSIE will be utilized to implement one or more distributed processing applications. AI applications will continue to develop and demonstrate high performance systems for easy retrieval and manipulation of tactical and graphics information, for producing correct and efficient programs from their specifications, for interfacing users to computer systems via natural language, for multi-sensor integration, tactical targeting and situation assessment. Natural language understanding will increase in utility and application as TEAM is improved to handle a wider range of dialogue and is interfaced to new databases. Prototype distributed systems for air fleet control and vehicle location and tracking will be developed.

(U) During FY 1984, basic research in machine representation and utilization of knowledge will focus on the requirements of distributed, cooperative problem solving systems, where each processor must maintain a model of the data and knowledge bases known to the other processors. Applications of knowledge engineering techniques will be demonstrated in prototype expert systems which emphasize intelligent user interfaces and multiple uses of a single knowledge base, e.g. for problem solving, explanation of its reasoning, tutoring, and acquiring new knowledge by analogy. A system for extremely flexible and efficient access to a large geographic knowledge base will be developed. Applicability of image understanding techniques to vision-based robotics will be explored for potential impact on manufacturing productivity. Evaluation of the intelligence photointerpreter system will commence, and natural language understanding will be incorporated into the system.

3. (U) Program to Completion: This is a continuing program. Developments in image understanding will continue to concentrate on areas of autonomous navigation and tracking of mobile targets. Research will continue on techniques for acquiring knowledge, for representing knowledge efficiently in intelligent computer systems, on development of understanding context of discourse on the conceptual development of expert systems and on new computer reasoning tools. Advanced techniques for mapping data from dissimilar sources into a common knowledge model will be developed, as will mechanisms for situation monitoring and alerting in command, control environments. Applications of artificial intelligence in command and control, signal processing and intelligent planning systems will be pursued.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-1
 Program Element: #61101E
 DoD Mission Area: 530

Title: Intelligent Systems
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

4. (U) Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes for Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Late FY 1982	Demonstrate the knowledge base processing concept for a data intensive planning system.	
---	Late FY 1982	Demonstration of a prototype memory to perform concurrent knowledge retrieval from a semantic inheritance network.	New Milestone
---	Late FY 1982	Demonstrate a planning system (AIRPLAN) for aircraft launch and recovery operations on an aircraft carrier.	New Milestone
Mid FY 1983	Mid FY 1983	Demonstrate a system that can acquire a knowledge base through an interactive dialogue in English and use that knowledge for cartographic problem solving (TEAM).	
---	Mid FY 1983	Demonstrate the Cartographic Workstation.	New Milestone

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-1
 Program Element: #61101E
 DoD Mission Area: 530

Title: Intelligent Systems
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

---	Late FY 1983	A very high level language for implementing expert systems will be demonstrated on distributed processors (ROSIE).	New Milestone
---	Mid FY 1984	Initial evaluation of an intelligent assistant for photo interpretation.	New Milestone

5. (U) Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Intelligent Systems	14,029	14,200	14,700	19,400

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-2
Program Element: #61101E
DoD Mission Area: 530

Title: Advanced Digital Structures & Network Concepts
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to build the technology base in the areas of advanced digital structures and network concepts as the base for future distributed military information processing systems. Design methodologies and computer aided design tools are being developed for Very Large Scale Integration (VLSI) technology which will reduce projected design time and cost over present trends. Design systems are being developed which permit the designer to start with a high-level description of the desired chip architecture, and interact with a computer to refine his design, develop test procedures and finally rely on the computer to create a suitable layout on the material substrate. Chips will be designed and fabricated to explore innovative architectures, including highly parallel structures, restructurable logic and new architectures for signal processing applications. Architectures will be developed for real-time symbolic (non-numeric) processing in applications such as image processing and natural language interfaces to command and control systems.

(U) Fundamental concepts are being explored for future C3 System Architectures and automated network management based on the use of distributed processing. Emphasis is being placed on the use of local networks in conjunction with long-haul packet network technology. A major goal of this research is to understand and thereby control the complexity and performance of the resulting system. Specific tasks will include developing user interfaces which simplify the access to distributed resources, developing techniques to facilitate resource sharing among computers, developing diagnostic tools and methodologies to allow for the rapid isolation of and recovery from network and host failures, and providing dynamic reconfiguration of resources in response to hostile environmental conditions or overload situations.

(U) RELATED ACTIVITIES: The multi-Service effort on Very High Speed Integrated Circuits (VHSIC) is focused on very high speed technology and complements the DARPA program which is addressing the architecture and design concepts for very large scale systems. NSF has a basic research program in submicron structures which is being coordinated with the DARPA program. DARPA maintains close technical liaison with DCA on new computer communications protocols and advanced network concepts.

(U) WORK PERFORMED BY: 70% University, 28% Industry and 2% In-house. The major performers are: MIT Lincoln Laboratory, Lexington, MA; Bolt Beranek and Newman, Cambridge, MA; University of Southern California, Information Sciences Institute, Marina del Rey, CA; Stanford University, Stanford, CA; Carnegie Mellon University, Pittsburgh, PA; California Institute of Technology, Pasadena, CA; Massachusetts Institute of Technology, Cambridge, MA; Columbia University, New York, NY; University of California, Berkeley, CA; University of California at Los Angeles, Los Angeles, CA.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-2
Program Element: #61101E
DoD Mission Area: 530

Title: Advanced Digital Structures & Network Concepts
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: VLSI design tools have been developed and used to design circuits having approximately 50,000 transistors. The design tools include the use of high-resolution color graphics, layout languages that support parameterized cells and various design constraints, and programs for generating minimum area programmable logic arrays (PLAs). An initial version of a silicon compiler has been developed for use in designing signal processing chips. A system has been developed which places the submodules on a chip and then automatically routes the interconnect wires. A technique for restructuring a large-area integrated circuit after fabrication has been developed and demonstrated using a laser-programmed linking strategy. A permeable base transistor device has been developed and initial versions demonstrated at 30 GHz. A number of innovative architectures have been designed and fabricated, including a single chip LISP interpreter, a reduced instruction set computer and a custom geometry chip for doing high performance graphics operations. A tree machine architecture has been defined and a tree machine processor designed. Circuits have been developed and tested which use a synchronous self-timing discipline, and highly parallel algorithms have been developed for systolic arrays and computational networks.

(U) A multi-media electronic message forwarding protocol was designed and documented. Program verification techniques were developed to demonstrate the correctness of both low-level and transport-level communication protocols. Algorithms have been developed for recovering from internet gateway failures by alternate routing and for rapidly interconnecting newly authorized gateways and networks to the internet without administrative action. A hierarchical file system which provides automatic migration of files between local storage, central storage and an archive has been designed, and the implementation of the name server, authentication server and synchronization server have been completed. Concepts for a gracefully interacting user interface have been developed.

2. (U) FY 1982 Program and FY 1983/FY 1984 Planned Programs: In FY 1982, VLSI design systems will continue to be developed. Silicon compiler techniques will be extended, generalized and improved. The use of artificial intelligence techniques for automatic layout of integrated circuits will be incorporated into the design systems. Design disciplines will be established that assure a correct correspondence between the high level notation of a circuit, its successive refinements and its implementation. Selected innovative architectures will be designed in detail, fabricated, and tested using the fast turnaround methodology. The permeable base transistor will be evaluated for use in both digital and analog circuits; the reduced instruction set computer will be completed; a large scale signal processing application will be

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-2

Program Element: #61101E

DoD Mission Area: 530

Title: Advanced Digital Structures & Network Concepts

Title: Defense Research Sciences

Budget Activity: 1. Technology Base

implemented using restructurable VLSI technology; a high performance graphics system based on the custom geometry chip will be developed; and development of a 1000 node tree machine will be initiated. Scaled analog circuits will be designed and fabricated using a process which is compatible with digital technology.

(U) An internet fault detection and isolation system employing distributed heuristic techniques is being designed to localize hard failures and to automatically assess the source of performance degradations. Protocols for automatic recovery from network partitioning using alternate internet routes are being developed. Strategies and concepts for internetwork resource allocation to provide adequate resources for the highest priority tasks are being investigated. Implementation of a hierarchically distributed file system is being completed and the performance of intelligent file migration algorithms will be evaluated. A cooperative interactive system for use on a personal workstation is being designed. A multi-media editing capability is being developed which will initially handle text and facsimile. Network access techniques are being extended to include voice input and output.

(U) In FY 1983 the evolution of VLSI design systems will continue, striving toward systems which can be used effectively to design VLSI chips having 1 million or more gates. Artificial intelligence techniques will continue to be integrated in these systems to allow high level design capabilities. Languages and methodologies for testing of large VLSI designs will be developed. A new thrust in VLSI Systems will be initiated, to address system level issues encountered in developing future system with VLSI technology. Issues to be explored include wafer scale integration, design of 3-dimensional systems and the software required to carry a new system from initial concept to design, fabrication and testing of the final product. Selected designs will continue to be fabricated and the minimum feature size will be decreased as technology permits. Theoretical research will include efforts in modeling VLSI computation complexity and in the theory of systolic computations. New architectures will continue to be investigated, with an emphasis on the exploitation of massive intrinsic parallelism.

(U) Experiments will be conducted to assess the effectiveness of internet fault detection, isolation and recovery mechanisms. Analytical models of the reliability and performance of multi-net systems will be developed. Research on cooperative interactive systems will address issues of robust communication, cooperative error correction, explanation of system capability and personalization of the system for individual users. Multi-media document editing will include voice annotation, and a more extensive voice command capability will be explored. Experiments will be conducted in dynamically migrating distributed processes across hosts. Experimentation with dynamic resource reservation techniques will be

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FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-2
Program Element: #61101E
DoD Mission Area: 530

Title: Advanced Digital Structures & Network Concepts
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

initiated. Design of an automated network resource management strategy will be initiated, including a remote instrumentation center to monitor and display network and host operating parameters.

(U) In FY 1984, research will continue in the areas of theoretical VLSI concepts, design systems and innovative architectures. A goal during this period will be to develop design methodologies, design verification approaches and testing methodologies to demonstrate the correct operation of VLSI chips. Selected designs will be fabricated, including highly parallel architectures such as systolic arrays and homogeneous machines. The various components of the cooperative interactive systems will be integrated to demonstrate and evaluate these concepts. Efforts will continue in developing effective use of multiple hosts to support distributed application. A system software concept for a portable terminal will be explored. Experiments with dynamic resource reservation will continue and resource reservation concepts will be extended to internet systems. Machine intelligence techniques for performance tracking, fault detection and isolation, and degradation detection will be integrated into an experimental internet monitoring and control system. Development of an initial automated resource management system will begin. Elements of a model C3 system architecture will be constructed using the Internet.

3. (U) Program to Completion: This is a continuing program. VLSI architecture and design effort aims to develop an integrated capability for the design, fabrication, and test of integrated circuits with in excess of a million gates by FY 1985. Designs will be scaled to submicron dimensions. Innovative architecture and testing procedures for use with VLSI will be developed. The application of artificial intelligence to internetwork monitoring, control and operation will be demonstrated. Research in cooperative interactive systems will provide a methodology for building services which share a natural, easy-to-use interface that is consistent across different services. Network based system concepts and techniques will be developed and investigated in the context of advanced C3 system. The automated resource management system will be completed and tested under real-time dynamic load conditions. The model C3 system architecture will be integrated, refined and evaluated.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-2
 Program Element: #61101E
 DoD Mission Area: 530

Title: Advanced Digital Structures & Network Concepts
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

4. (U) Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Early FY82	Late FY 1982	Demonstrate Working Tree Machine.	Original design software lacked sufficient functionality
Mid FY 1982	Mid FY 1982	Demonstrate restructurable logic with 100,000 transistor circuit.	
Mid FY 1982	Mid FY 1982	Demonstrate network partition recovery capability.	
Late FY 1982	Late FY 1982	Complete integration of distributed file and internet recovery system.	
----	Mid FY 1983	Incorporate standard CMOS rules in VLSI design tools.	New Milestone
----	Mid FY 1983	Demonstrate prototype cooperative interactive system in context of a multi-media message system.	New Milestone
----	Late FY 1983	Demonstrate multi-processor containing 1000 processors.	New Milestone

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-2

Title: Advanced Digital Structures & Network Concepts

Program Element: #61101E

Title: Defense Research Sciences

DoD Mission Area: 530

Budget Activity: 1. Technology Base

---- Late FY 1984 Demonstrate cooperative interactive New Milestone
system which supports
multiple application domains.

---- Mid FY 1985 Demonstrate VLSI circuit New Milestone
containing 1 million transistors.

5. (U) Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Advanced Digital Structures and Network Concepts	13,875	16,275	21,700	25,600

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-3
Program Element: #61101E
DoD Mission Area: 530

Title: Modernization Technology
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION: This project is aimed at providing a base of modern computing resources in U.S. Universities which is needed to carry out state-of-the-art research in information processing, and developing the technology base to increase defense productivity. This area was recently highlighted by the Defense Science Board as a critical area for investment if the U.S. technology leadership in information processing is to be maintained. Existing equipment, which in some cases is almost twenty years old, will be upgraded from large time-sharing systems to powerful single-user systems on local networks. Experimental computer resources such as symbolic processors with large address space and high resolution graphics displays are being provided to U.S. Universities performing DoD research to stimulate innovation in the fields of artificial intelligence, VLSI architecture, software technology, design systems, robotics and automated manufacturing.

(U) Efforts are being initiated to explore ways in which information processing can close the gap between the generation of ideas and their concrete realization in the form of visual models, physical objects, or mechanical systems. This will include the design of systems for describing and transforming shape and motion information, the synthesis of complex mechanical structures and the recognition and representation by computers of 3-dimensional scenes which can be derived from sensor information. High-resolution graphics systems will be used to aid in the description of complex objects and to provide a graphical representation of objects described by information structures. Design of a highly capable real-time controller for the intelligent manipulation of physical objects is being initiated. Techniques will be explored which would improve the productivity of scientific researchers by providing automated assistance for those manual tasks which are tedious, time-consuming and error-prone.

G. (U) RELATED ACTIVITIES: The National Science Foundation (NSF) is providing experimental computer resources to non-DoD university researchers, and the Office of Naval Research is funding a robotics effort which is related to the tasks to increase defense productivity.

H. (U) WORK PERFORMED BY: 17% Industry, 70% University, 13% In-house. Work being carried out by Rand Corporation, Santa Monica, CA; Bolt, Beranek & Newman, Cambridge, MA; University of Southern California, Information Sciences Institute, Marina del Rey, CA; Massachusetts Institute of Technology, Cambridge, MA; University of California, Berkeley, CA; Stanford University, Palo Alto, CA; and Columbia University, New York, NY.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

074 (U) FY 1981 and Prior Accomplishments: This is a new project.

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FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-3
 Program Element: #61101E
 DoD Mission Area: 530

Title: Modernization Technology
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

2. (U) FY 1982 Program and FY 1983/FY 1984 Planned Programs: This project was initiated in FY 1982 by aggregating existing efforts in Intelligent Systems (CCS-1) and Advanced Digital Structures and Network Concepts (CCS-2) to provide needed experimental computer resources in approximately ten critical research laboratories. This is the initial phase of a planned 5 year effort to modernize the computer resource base in these laboratories. Exploratory work in the design of a real-time controller for advanced manipulators is being initiated. Seminars and workshops are being conducted to focus the research on areas having the greatest payoff.

(U) In FY 1983, the computer resource modernization effort will continue. The development of a prototype controller for advanced manipulators will be initiated. Both theoretical and experimental research will be conducted in the use of Beta-splines to represent and modify geometric shapes. An effort to understand signals from complex 3-dimensional scenes will be initiated, and a graphical connection-based style of interactive design will be explored.

(U) In FY 1984, the experimental computer resource modernization effort will continue. A system for iterative design, modification and evaluation of complex physical structures will be designed. The results of the research in describing shapes will be applied to the prototyping of simple objects based on their mathematical description. The prototype real-time controller will be demonstrated in conjunction with the advanced manipulators. Three-dimensional scene understanding involving motion will be demonstrated for simple tasks.

3. (U) Program to Completion: State-of-the-art computing resources will be established and maintained in critical research laboratories. A technology base will be developed to improve defense productivity through the application of advanced information processing techniques to rapid design and prototyping, robotics, portable super computers, and by providing software tools and programming support to enable more innovative use of advanced computer resources.

4. (U) Milestones:

<u>Last year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes for Milestones Reported in FY 1982 Descriptive Summaries</u>
----	Mid FY 1982	Initiate Computer Resource Modernization at 4-5 labs.	New Milestone

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FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #CCS-3 Title: Modernization Technology
 Program Element: #61101E Title: Defense Research Sciences
 DoD Mission Area: 530 Budget Activity: 1. Technology Base

---- Late FY 1983 Demonstrate the use of New Milestone
 Beta-splines to graphically
 describe geometric shapes.

---- Late FY 1984 Demonstrate prototype New Milestone
 controller with advanced
 manipulators.

5. (U) Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Modernization Technology	0	5,425	5,400	10,000

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #UDR-1
Program Element: #61101E
DoD Mission Area: 530

Title: Unconventional Detection Program
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: This activity will evaluate the feasibility of detecting submarines using non-acoustic techniques, applicable approaches include detection of

detection methods, operational feasibility is being analyzed

For these types of

The effort is being pursued in three broad areas: (1) Characterization and understanding of the properties of both the signal signature and background interference noise sources; (2) development of experimental sensors that can be used to detect signals of interest; and (3) development of signal processing methods on the sensor output in order to achieve target detection.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #UDR-1
Program Element: #61101E
DoD Mission Area: 530

Title: Unconventional Detection Program
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

Experimental sensor development is directed towards a feasibility of a new class of

- G. RELATED ACTIVITIES: This program is complementary to the Navy's exploratory development program on non-acoustic ASW. The development of an experimental fiber optic is a component of the Fiber Optic Sensor System program jointly sponsored by DARPA and the Navy. The study of
- The study of optical properties of the ocean medium is connected to DARPA's Strategic Laser Communications program. Coordination mechanisms include participation in the Office of Under Secretary of Defense for Research and Engineering (OUSDR&E) reviews of the Advanced Development Coordinating Committee and briefings to CNO's Working Group and Defense Science Board task forces.
- H. WORK PERFORMED BY: 60% of the efforts are funded to industry which include: Poseidon Research, Los Angeles, California; Arete Associates, Encino, California; Physical Dynamics, Incorporated, Arlington, Virginia; Pacific-Sierra Research Corporation, Santa Monica, California; SRI International, Menlo Park, California; Texas Instruments, Dallas, Texas; and The Analytic Sciences Corporation, Reading, Massachusetts. Service laboratories performing 35% efforts are: the Naval Research Laboratory; the Naval Post-Graduate School; the Naval Air Development Center; the Naval Ocean Systems Center; and the Naval Underwater Systems Center. University participation encompassing 5% of the effort is conducted by: Lawrence Berkeley Laboratory, Berkeley, California.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:
1. FY 1981 and Prior Accomplishments: were analyzed and evaluated.

SUMMARY

Project: #UDR-1
Program Element: #61101E
DoD Mission Area: 530

Title: Unconventional Detection Program
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

Finally, a computer model was developed to allow the testing of various detection algorithms.

the program efforts involved a parametric study to determine the range of ocean environmental conditions and encounter geometries leading to favorable detection;

advanced and research into the development of

2. FY 1982 Program and FY 1983/1984 Planned Programs: On the basis of work performed to date, the FY 1982 program in the detect system to accuracies which can detect Upon successful completion of the construction of the system, an experiment will be conducted to detect (developed under this program during prior years) and other instrumentation which provides In addition, work will continue on the development of

In the area, an at-sea experiment will be designed whose goal is the measurement of

submarine Work will also continue on numerical and analytic efforts towards the modeling of

Research efforts will continue on the achievement of high sensitivity in the low frequency regime.

Finally, work on alternate technologies for extremely sensitive

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #UDR-1
 Program Element: #61101E
 DoD Mission Area: 530

Title: Unconventional Detection Program
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

Effort in FY 1983 will concentrate on analyzing the data from the FY 1982 experiment and on the conduct of an at-sea experiment employing an

The increase in the estimated FY 1983 program over the FY 1982 program is to support the planned at-sea experiments and to analyze the data collected during the FY 1981 experiment. The FY 1983 program will also include the continued development of

FY 1984 efforts will complete at-sea testing will be performed using

These tests

3. Program to Completion: Continuation beyond FY 1984 will depend upon new concepts that arise during the program that have not yet been identified. Otherwise, it is expected that the program will transition to the Navy.

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Late FY 1981	Ocean Optics Experiment.	Completed.
Mid FY 1982	--	at-sea Experiment.	Cancelled due to delay in sensor delivery to Navy and funding reduction.
Mid FY 1982	Late FY 1982		Improved weather and environmental conditions for test.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #UDR-1
Program Element: #61101E
DoD Mission Area: 530

Title: Unconventional Detection Program
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Late FY 1982	Sensor	No change.
Mid FY 1983	Late FY 1983		Analysis of FY 1982 experiment must be completed first.
Mid FY 1983	Late FY 1983		Specification of equipment requirements must be completed first.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Unconventional Detection Program	3,378	7,050	14,500	18,800

This program is jointly funded with the Navy.

FY 1983 RDT&E Descriptive Summary

Project: #DRT-1
Program Element: #61101E
DoD Mission Area: 530

Title: Target Penetration Research
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The technical objectives of the Target Penetration Research program are to investigate the

, and
shock and combustion wave techniques to synthesize and consolidate materials for DoD application. The potential technical impact of these activities will be to allow to enter exploratory development Advancement in scientific understanding of

. The development of a scientific understanding of dynamic synthesis and consolidation techniques will allow for the use of advanced materials with enhanced properties for applications which involve a high pressure or high temperature environment.

- G. RELATED ACTIVITIES: The Target Penetration Research Program was established in FY 1981. This project addresses critical research issues in support of the DARPA exploratory developmental program in Advanced Armor Technology. Coordination of current activities is maintained with the Office of the Undersecretary of Defense Research and Engineering and appropriate Service laboratories. In particular, coordination is maintained with the Army Armaments Research and Development Command, Research Office, and Missile Command, the Naval Surface Weapons Center, and the Air Force Armaments Testing Laboratory.

FY 1983 RDT&E Descriptive Summary

Project: #DRT-1
Program Element: #61101F
DoD Mission Area: 530

Title: Target Penetration Research
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

H. WORK PERFORMED BY: About 45% of this program is contracted to industry; the remaining 55% is contracted to universities. The principle industrial contractors are: Battelle Columbus Laboratories, Columbus, Ohio; Physics International, San Leandro, California; Science Applications Incorporated, Palo Alto, California; System Planning Corporation, Arlington, Virginia; and System Science and Software, Inc., La Jolla, California. The universities are University of California, Berkeley, California; University of Denver - Denver Research Institute, Denver, Colorado; Drexel University, Philadelphia, Pennsylvania; University of California - Los Alamos National Laboratory, Los Alamos, New Mexico; Massachusetts Institute of Technology, Boston, Massachusetts; and North Carolina State University, Raleigh, North Carolina.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The Target Penetration Research program was initiated in FY 1981.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs:

FY 1983 RDT&E Descriptive Summary

Project: #DRT-1
Program Element: #61101E
DoD Mission Area: 530

Title: Target Penetration Research
Title: Defense Research Sciences
Budget Activity: 1. Technology Base

. New efforts are underway to conduct detailed research on shock activation techniques, self-propagating high-temperature synthesis, plasma-arc synthesis, and dynamic consolidation of ceramics. If successful, these techniques will provide materials with enhanced properties of direct interest to the DoD.

In FY 1983, . Research initiated in FY 1982, on dynamic synthesis and consolidation techniques for ceramics will expand.

. As solutions to technical issues posed in FY 1981 and FY 1982 are provided, new efforts will be incorporated into the program.

In FY 1984, The effort in the dynamic synthesis and consolidation of ceramics will bifurcate into two activities. The first will continue with basic research of a general nature addressing the many technical issues associated with the selected dynamic techniques. The second will conduct research on advanced materials

FY 1983 RDT&E Descriptive Summary

Project: #DRT-1
 Program Element: #61101E
 DoD Mission Area: 530

Title: Target Penetration Research
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

designed for specific DoD applications.

3. Program to Completion: The Target Penetration Research program is a continuing program. New initiatives are evaluated continually as research issues are solved and advanced concepts transfer to exploratory development. The dynamic synthesis and consolidation effort will continue through FY 1986. In FY 1986, programmed basic and applied research in this technical area will be completed and all developed technology will be transferred to the Services.

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes From Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Mid FY 1982	Initiate program in Dynamic Synthesis and Consolidation of Materials.	New Milestone.
Late FY 1982	Late FY 1982		Activity was not funded in FY 1981. Activity has been expanded for FY 1982 and FY 1983 and transitioned to exploratory development.
--	Late FY 1983	First demonstration of dynamically synthesized or consolidated materials.	New Milestone.

5. Resources: (\$ in Thousands)

FY 1983 RDT&E Descriptive Summary

Project: #DRT-1
 Program Element: #61101E
 DoD Mission Area: 530

Title: Target Penetration Research
 Title: Defense Research Sciences
 Budget Activity: 1. Technology Base

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Target Penetration Research	845	2,500	3,300	4,000

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62101E
DoD Mission Area: 530

Title: Technical Studies
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in Thousands)

Project Number	Title	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		\$ 3,145	\$ 3,000	\$ 3,300	\$ 3,600	Continuing	N/A
TS-1	OUSDR&E Support	\$ 3,145	\$ 3,000	\$ 3,300	\$ 3,600	Continuing	N/A

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program support independent, topical, indepth studies and analyses requested by the Office of the Under Secretary of Defense for Research and Engineering (OUSDR&E), and its various component offices. Each year the most urgent subjects are chosen by the directors of Land Warfare, Command, Control and Communications, Strategic and Space Systems, Tactical Warfare, Naval Warfare, Research and Advanced Technology and others. The Institute for Defense Analyses (IDA) provides unbiased in-depth answers to those problems enabling the decision makers to make rational judgements and decisions.

C. BASIS FOR FY 1983 RDT&E REQUEST: Detailed topics for FY 1983 have not been defined at this time. However, the same general defense areas will be studied with emphasis on the then pressing aspects of national defense and U.S. military posture and U.S. NATO Allies. Topics such as cruise missile survivability in the light of Soviet air defense improvements; air defense suppression for attack of targets within Soviet Army area; and system alternatives for air interdiction that advancing technology could make available for the 1990s will be examined. Other study areas will be defined as the FY 1983 approaches.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The funding levels of these studies are the same as that submitted in the FY 1982 Descriptive Summary. There are no milestones associated with this program.

E. OTHER APPROPRIATION FUNDS: None

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #TS-1
Program Element: #62101E
DoD Mission Area: 530

Title: OUSDR&E Support
Title: Technical Studies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The studies and analyses supported in this program element are performed by the Institute for Defense Analyses (IDA) for the Office of the Under Secretary of Defense, Research and Engineering (OUSDR&E) and its component elements. The studies provide assessments of the feasibility and detailed projections of potential technological developments; comparative performance and cost estimates for alternative systems to meet specific strategic or tactical missions; and analyses of the potential output from various technology base programs under alternate development strategies, keyed to long-term mission requirements. Since IDA works exclusively for the Office of the Secretary of Defense (OSD) and the Joint Chiefs of Staff (JCS) within the Department of Defense (DoD), its studies are free from real or apparent influence by Service or industry positions or advocacy. As a result, IDA is granted access to sensitive or proprietary data on competing systems, which might otherwise not be made available, enabling it to perform studies with a high level of objectivity and thoroughness.
- G. RELATED ACTIVITIES: The work performed under this program element is related and contributes data to the program management activities of OUSDR&E. Specific offices that have been supported include those of the Deputy Under Secretaries, Defense Research and Engineering (DUSDR&E) for: Command, Control, Communications and Intelligence; Acquisition Policy; Research and Advanced Technology; Tactical Warfare Programs; Strategic and Space Strategic and Theater Nuclear Forces Systems, and Atomic Energy.
- H. WORK PERFORMED BY: This research is performed by the Institute for Defense Analyses, Arlington, Virginia (FCRC 100%).
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:
1. FY 1981 and Prior Accomplishments: IDA continued work related to tactical air and ground warfare systems, communications related to strategic systems, some technology-base issues, and diverse other topics related to strategic warfare, naval warfare, and some major Defense Program management issues. In the area of tactical air warfare systems, IDA reviewed the relationship between Service air defense suppression programs and the expected capability of Soviet tactical air defenses, to ascertain whether the programs are consistent with the defense capabilities and vulnerabilities. Various aspects of Advanced Short Range Air-Air Missile guidance systems

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #TS-1
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Title: OUSDR&E Support
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were reviewed, with particular attention to showing OUSDRE the stature of European infrared sensor and guidance technology in relation to that of the U.S. This work has been designed to help USDRE manage the interchange of technology with our NATO allies under the Family of Weapons program and pertinent Memoranda of Understanding.

A major effort was undertaken, for the DUSD (Tactical Warfare Programs), to compare and evaluate the large set of programs, involving various aircraft, air and ground-launched missiles, and precision target acquisition and weapon guidance subsystems, designed to interdict the second echelon forces of attacking Soviet armies in the European theater. The purpose of this effort, designated the Indirect Fire Support Study, is to provide technical data which the DUSD (TWP) needs to select the most effective and workable approaches to the problem from among the great diversity of potentially redundant programs in this complex mission area. There was also a comparison, for the same office, of the relative cost-effectiveness of ground-force anti-tank weapons (including armed helicopters) in existence and in development.

An assessment of potential means to defeat the Soviet tactical ballistic missile threat against airfields and other major targets in Central Europe, including the possibilities for adapting the PARTIOT air defense system or acquiring wholly new systems for the purpose, was undertaken for the Principal Deputy USDRE.

A review was performed for the DUSD (C³I), of NATO plans, organization, policies, and procedures pertaining to the allocation and utilization of radio frequencies in peace and wartime; the results of this work are proving useful to DoD and other U.S. federal agencies in NATO radio frequency coordination negotiations.

IDA also continued work on issues related to the security (non-detectability) of the U.S. SSBN force, and assessments of the survivability of U.S. strategic cruise missiles, based on the DoD live-firing tests using U.S. air defense systems.

An effort was initiated to define the characteristics of future EHF military communications satellite systems to provide jamming-resistant communications, with particular applicability and concern for communications in strategic warfare situations.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #TS-1
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IDA also analyzed how the new long-range theater nuclear forces planned for deployment in Europe could be related, in political/military terms, to the overall U.S. force structure including other tactical as well as strategic nuclear forces, and continued long-ongoing assessments of the R&D and acquisition balance between the U.S. and USSR. In addition, there was a detailed review and risk assessment of sensors and sensor technology that could be used to monitor compliance with a Comprehensive Test Ban Treaty.

In areas related to the technology base (including basic and applied research toward new Defense capabilities), IDA examined possibilities and limitations in the use of millimeter-wave radar to supply target acquisition information in adverse weather; assessed the suitability of Synthetic Aperture Radar for guiding small tactical missiles; assessed the status of infrared search and track technologies; and prepared a report, widely disseminated through DoD, on how consideration of adverse weather effects on guidance subsystems should be incorporated in the major systems acquisition process.

Two tasks were undertaken in relation to the Very High Speed Integrated Circuit (VHSIC) program; a contribution to software development for a standard Hardware Description Language (HDL) to be used in the design of VHSIC chips; and a review of signal processing requirements for VHSIC application to automatic target recognition.

A study report was prepared recommending improvements in the DoD/DARPA materials and structures R&D planning process.

Foreign (Western world) capabilities in composite materials were reviewed and compared with those of the U.S. for application to government planning and negotiations related to export control of militarily critical technologies (under the Export Administration Act of 1979).

A special area of concern in FY 1981 was a comparison of the efficacy and cost of maintenance training using actual equipment or equipment simulators.

IDA also completed a major study of the DoD's requirements for strategic and critical materials, and the relationship of these requirements to national critical and strategic material utilization, stockpiling, and

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #TS-1
Program Element: #62101E
DoD Mission Area: 530

Title: OUSDR&E Support
Title: Technical Studies
Budget Activity: 1. Technology Base

management capabilities under the law. The DoD used the results of this study in its report to Congress as required by the National Materials and Minerals Policy, Research and Development Act (P.L. 96-479).

A study was also undertaken to help calculate defense industrial requirements for accommodating a major force expansion; the FY 1981 work developed a mobilization planning model that is being used by the USDRE Office of Acquisition Management in planning studies related to industrial mobilization.

Finally, funds in this line item supported a study of the relationship between indicators of technical complexity of selected Defense systems and materiel readiness of aircraft, helicopters, and avionic subsystems. This study made a major contribution to the work of the Defense Science Board Task Force on Readiness during the Summer of 1981.

2. FY 1982 Program and FY 1983/84 Planned Programs: Several of the above efforts will continue in FY 1982. This includes the technology-base work in the areas of electro-optical and millimeter-wave guidance, and standard HDL and interoperability standards for VHSIC chips. An effort is being undertaken to examine the potential of new anti-armor technologies. Methods are being sought for estimating the cost and effectiveness of training equipment and procedures before they are implemented in training programs. Work is continuing in the areas of EHF satellite communications, SSBN security, cruise missile survivability, the role of the theater nuclear forces, and assessment of the U.S. and Soviet research, development, and acquisition balance with particular attention to army systems. Work is also continuing on the topics of industrial mobilization and materiel readiness, and attention will be given to production rate effects on costs of selected Army systems. The major effort in the area of indirect fire support, described above, also continues. Earlier work on critical materials is being extended in more detail and in particular will examine the substitutability of materials in such areas as aircraft propulsion and structures. Other, newly defined, problems and study areas will be determined by the Office of the Undersecretary of Defense for Research and Engineering. In general, these studies are designed to yield results of assistance to the using office of OUSDR&E as closely as possible to the time when the issues arise.

The FY 1983 work is expected to continue technical studies for the offices of the Deputy Undersecretaries for Research and Advanced Technology, Tactical Warfare Programs, Strategic and Theater Nuclear Forces, Acquisition

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #TS-1
 Program Element: #62101E
 DoD Mission Area: 530

Title: OUSDR&E Support
 Title: Technical Studies
 Budget Activity: 1. Technology Base

Management, and the Assistant for Assessment. As indicated above, the program will be based on important current issues, defined at the time the FY 1983 appropriation becomes available.

3. Program to Completion: This is a continuing program.

4. Milestones: The varied studies defined by the task orders issued will generally be completed in approximately 12 months.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
OUSDR&E Support	\$ 3,145	\$ 3,000	\$ 3,300	\$ 3,600

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 62301E
DoD Mission Area: 530

Title: Strategic Technology
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in Thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional To Completion</u>	<u>Total Estimated Costs</u>
TOTAL FOR PROGRAM ELEMENT		<u>\$125,354</u>	<u>\$148,631</u>	<u>\$151,900</u>	<u>\$160,000</u>	<u>Continuing</u>	<u>N/A</u>
ST-1	Advanced Strategic Concepts & Strategic Technical Analysis	2,871	2,778	3,100	5,600	Continuing	N/A
ST-2	Space Surveillance & Advanced Optics	18,953	16,315	20,500	21,000	Continuing	N/A
ST-3	High Energy Laser Technology	23,063	46,557	44,700	59,800	Continuing	N/A
ST-4	Strategic Deterrent	3,933	7,767	9,500	20,500	Continuing	N/A
ST-5	Strategic Delivery Vehicles	33,162	30,650	27,200	31,800	Continuing	N/A
ST-6	Warning Technology	8,624	8,998	7,600	10,300	Continuing	N/A
ST-7	Special Applications Technology	2,954	2,966	5,300	7,500	Continuing	N/A
ST-8	Space Object Identification	4,453	4,400	2,800	3,500	Continuing	N/A
ST-9	Submarine Laser Communication	27,341	28,200	31,200	-0-*	-0-	95,049

* Project ST-9 transfers to PE62711E in FY 1984.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 62301E
DoD Mission Area: 530

Title: Strategic Technology
Budget Activity: 1. Technology Base

- B. **BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:** This element funds a comprehensive research and development program directed toward the development and application of advanced technologies associated with advanced strategic system concepts; electrooptical sensors; laser devices; ballistic missile defense; strategic delivery vehicles; space surveillance systems and multimission radar concepts; post attack communication system; multi-application spaceborne signal processor; space object identification; and submarine communication.
- C. **BASIS FOR FY 1983 RDT&E REQUEST:** The Advanced Strategic Concepts Technology and Strategic Technical Analysis program provides the initial theoretical analysis needed to define advanced strategic concepts, to assess their general utility, and to establish criteria to judge the impact of technology advances on strategic options. The Space Surveillance and Advanced Optics, and the Warning Technology programs are providing the technologies for new space surveillance systems that decrease warning time, provide attack characterizations, and permit new options for strategic defensive and offensive force management. The High Energy Laser Program is developing the technology base for

. Efforts are underway for both near-term

. The Strategic Deterrent program develops technology for a range of defense techniques that could nullify the massive Soviet offensive weapons inventory. Areas of concern include options, survivability applications for space systems, technology for ballistic weapons, and a weapon to

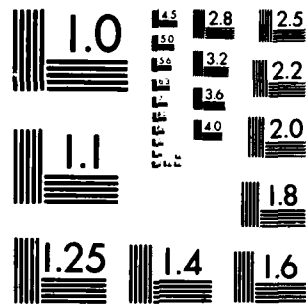
at long ranges using ballistic weapons technology. The Strategic Delivery Vehicles program is developing and demonstrating the technologies necessary to maintain and improve the survivability and effectiveness of strategic and tactical manned and unmanned airborne delivery systems. The Special Applications Technology program is developing advanced signal processing capabilities and options for strategic communications. The Space Object Identification program is demonstrating an optics technique that will provide space objects from a ground based telescope and is investigating the feasibility of full-time based on the optics and detector array technologies being developed in the Space Surveillance and Advanced Optics program. The Submarine Laser Communications program is investigating systems concepts and advancing device and optics technology for communication to submarines at operating depths using laser beams from a satellite in the blue/green spectrum.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 62301E
DoD Mission Area: 530

Title: Strategic Technology
Budget Activity: 1. Technology Base

- D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The Advanced Strategic Concepts & Strategic Technical Analysis project reflects a funding increase of \$1,778 in FY 1982 and \$500 in FY 1983 due to increased emphasis on exploring viable new strategic technology initiatives. The Space Surveillance & Advanced Optics funding decrease (\$185) in FY 1982 reflects minor funding realignment while the FY 1983 funding increase of \$8,300 reflects enhanced funding for DARPA's share of the DARPA/USAF Joint Technology Program for Missile Surveillance. Increased funding in the High Energy Laser Technology Project in FY 1982 (\$7,957) and FY 1983 (\$6,900) reflects expansion of efforts to reduce technical uncertainties in critical areas associated with Space-Based Lasers. These funds will be used to address issues, as well as advanced laser technologies. The Strategic Deterrent project funding increase (\$225) in FY 1982 represents a minor program realignment, while the decrease of \$1,400 in FY 1983 reflects adjustment of priorities with other projects. The Strategic Delivery Vehicles Project funding for FY 1982 decreased \$7.0 million due to a decrease associated with the Cruise Missile Detection Technology Program field instrumentation equipment. In FY 1983, the \$17.2 million reduction in funding resulted from the transfer of advanced cruise missile efforts to the USAF. The Warning Technology project increases by \$798 in FY 1982 and by \$1,300 in FY 1983, due to initiation of the HI-CAMP II sensor development to support the TEAL RUBY Space Experiment. The Special Applications Technology project funding decreases of \$4,066 in FY 1982 and \$800 in FY 1983 reflect readjustment of program funding priorities. The Space Object Identification funding increases by \$1,800 in FY 1982 and \$700 in FY 1983 to complete installation and on-site testing of the Compensated Imaging System at the ARPA Maui Optical Station (AMOS). Increased funding in FY 1982 of \$8.0 million for the Submarine Laser Communication (SLC) program reflects a Congressionally directed increase in the project to accelerate development of tactical airborne SLC, and tactical and strategic satellite SLC capabilities.
- E. (U) OTHER APPROPRIATION FUNDS: None.



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-1
Program Element: #62301E
DoD Mission Area: 530

Title: Advanced Strategic Concepts and Strategic Technical Analysis
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: Project objectives are to identify and thoroughly evaluate advanced strategic system concepts and system technologies in order to define critical technological issues and establish priorities for future strategic technology developments. The project deals directly with theoretical analyses and experimental efforts which are: to provide a basis for defining and evaluating the implications of technology on future weapons system designs and capabilities; to develop new initiatives that could significantly alter military effectiveness; to assess the implications of new technology on strategic policy and conversely the technological implications of new strategic policy; and to support the Office of the Under Secretary of Defense for Research and Engineering in establishing feasibility and priorities on present and proposed R&D programs and to technically evaluate the technological and capability implications of various treaty provisions. This project through its Advanced Strategic Analysis Task provides basic analytical feasibility for new strategic technology programs both within DARPA and for OUSDR&E, while the New Initiatives effort provides seed funding for advanced strategic concepts and technology through both analysis and experiment.
- G. RELATED ACTIVITIES: The program relates directly to programs of the Office of the Under Secretary of Defense for Research and Engineering, the Air Force Aeronautical Systems Division, the Army Ballistic Missile Defense Advanced Technology Center, the Air Force Space Division, the Air Force Rome Air Development Center, the Naval Ocean Systems Center, and the Naval Electronic Systems Center.
- H. WORK PERFORMED BY: About ninety percent of the project efforts are conducted by industry. The major contractors are: General Research Corporation, Santa Barbara, California; Lockheed Missiles and Space Company, Palo Alto, California; Toyon Research, Santa Barbara California; Rockwell International, Seal Beach, California; The Rand Corporation, Santa Monica, California; Boeing Aircraft Company, Seattle, Washington; Grumman Aerospace Corporation, Bethpage, New York; Booz Allen & Hamilton, Incorporated, Bethesda, Maryland; System Planning Corporation, Arlington, Virginia; and Vought Corporation, Dallas, Texas. The Office of Naval Research, Washington, D.C.; Massachusetts Institute of Technology, Boston, MA, and the Naval Research Laboratory, Washington, D.C. perform the remaining ten percent of the effort.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-1
Program Element: #62301E
DoD Mission Area: 530

Title: Advanced Strategic Concepts and Strategic Technical Analysis
Title: Strategic Technology
Budget Activity: 1. Technology Base

1. FY 1981 and Prior Accomplishments: A study was completed to determine the technology issues and the military payoff for the use of a vehicle. Such a system would provide a single stage rocket that boosts to the target. The flight path may allow for of the enemy

An investigation was initiated in FY 1980 for techniques that may be used by B-52's for detecting The principle threats are the

A technical analysis was initiated to illuminate the critical issues associated with future decisions on the development and acquisition of cruise missile carriers and penetrating aircraft to replace the B-52. Determinations have been made in this program of the costs and risks for maintaining the B-52 as a cruise missile carrier and for enhancing its survivability to the threat; whether the U.S. should have a new strategic aircraft and its characteristics; and techniques for enhancing cruise missile carrier survivability and the utility of new armament concepts for such survivability. A portion of these activities were requested by the Office of the Under Secretary of Defense for Research and Engineering to provide technical trade-offs in areas that have "high visibility" or are approaching a major decision milestone. The physical security, communications, power subsystem, cost and technical trade-off issues in proposed mobile ICBM basing concepts were investigated. A study to determine the penetration capability and susceptibility to countermeasures of present generation air-launched and sea-launched cruise missiles and bombers was undertaken. Trade-off analyses were made on the technical issues and alternatives for the MX multiple aim-point concepts, MX missile options, other MX basing options, and the uses of a conventional strategic ballistic missile submarine. Utility and configuration analyses were conducted for the C-X transport. A study was concluded of the potential of to protect U.S. satellites from enemy antisatellite attacks using It was also determined that it is feasible to introduce payloads in order to disrupt enemy

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: DARPA is searching out new ideas and areas requiring new technology initiatives in order to assure that the appropriate strategic balance is maintained and has increased the funding levels in FY 1982-1984 accordingly to attract high quality ideas. The DARPA strategic technology new initiatives tasks are incorporated in this project for FY 1982 and subsequent. Efforts continue from last fiscal year (a) to define technology thrusts that must be initiated to support the command and control

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-1
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DoD Mission Area: 530

Title: Advanced Strategic Concepts and Strategic Technical Analysis
Title: Strategic Technology
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(b) to determine jointly with Air Force whether techniques can be used for a low cost system to warn of a submarine launched, cruise missile attack, and (c) to examine a technique to autonomously determine the position of US satellites that exceeds current US ground based capabilities. The potential is being examined for providing a survivable communications network from the National Command Authorities to operational commanders by internetting. These stations already have protection against electro-magnetic pulses generated by nuclear burst. The technical issues involve how to and how to simultaneously maintain the fidelity of both the Another command, control and communications concept involves use of antennas for emergency action message transmission to Naval forces. A antenna would be hoisted by an aerostat to backup, augment or reconstitute communication. Key technical issue is to design an antenna that minimizes in various atmospheric environments. Technical requirements and technology impacts are being assessed for concepts to The impact would, as a minimum,

Use of is also being examined for

In FY 1983, efforts will be continued to encourage new ideas for defensive/offensive strategic weapons and command, control and communications. The project will provide for the rapid assessment of high payoff technologies that could have the potential of changing the strategic balance. New thrusts for strategic technology will emerge from this project. Support will continue under portions of this project. The Office of the Under Secretary of Defense for Research and Engineering in evaluating the impacts and technology needs for survivability, endurance and effectiveness of strategic weapons.

The FY 1984 objectives will be identical to those in FY 1983.

3. Program to Completion: The research and analyses, conducted in this program are normally completed within a one-to-two year period at which time, if they are successful, they are either transitioned to the Services or to new DARPA program thrusts. As new technology is developed, or as new concepts arise that require analyses and

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-1
 Program Element: #62301E
 DoD Mission Area: 530

Title: Advanced Strategic Concepts and Strategic Technical Analysis
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

exploration, the technical analyses and evaluation will be initiated to establish the required feasibility and technology development.

4. Milestones: Efforts are basically in the category of analyses or short experiments and do not have major milestones.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Advanced Strategic Concepts and Strategic Technical Analysis	2,871	2,778	3,100	5,600

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-2
Program Element: #62301E
DoD Mission Area: 530

Title: Space Surveillance and Advanced Optics
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: This project is developing and demonstrating the critical elements of electro-optical sensor technology necessary to maintain the current advantageous strategic surveillance position held by the U.S. in the face of an evolving Soviet threat. In particular, the objectives are; (1) to maintain launch warning and spacetrack capability against the potential of and (2) to provide the ability for spaceborne surveillance encompassing

For this purpose; advanced infrared sensor technology must provide

and demonstrated by the High Altitude Large Optics (HALO) program to achieve these objectives is the high sensitivity mosaic staring sensor which is able to background. The technology base developed will support decisions in the mid-1980's on advanced infrared surveillance systems.

- G. RELATED ACTIVITIES: The project is directly related to strategic efforts of the Army, the Air Force and the Navy. DARPA has the responsibility for technical data interchange with the Services and the Defense Agencies involved with strategic infrared technology developments. Within DoD, there are interrelations with the Air Force Systems Command, Aerospace Defense Command, and Strategic Air Command; the Army Ballistic Missile Defense Program Office; the Naval Research Laboratory, the Naval Ocean Systems Center; the Naval Air Development Center; and the Office of the Under Secretary of Defense for Research and Engineering. A transfer of the HALO technology to the USAF for advanced missile surveillance is planned in a joint technology program established and funded by the USAF and DARPA to support a mid-1980's decision for an Advanced Warning System.

- H. WORK PERFORMED BY: Ninety-eight percent of the efforts under this project are performed by industry. Approximately one percent is performed by Federal Contract Research Centers (FCRCs). Less than one percent is performed by universities. Primary contractors are: Rockwell International, Seal Beach, California; Lockheed Missiles and Space Company, Sunnyvale, California; Hughes Aircraft Company, Culver City, California; Charles Stark Draper Laboratory, Cambridge, Massachusetts; Honeywell, Inc., Minneapolis, Minnesota; Magnavox Government Industrial Electronics Company, Mahwah, New Jersey; Eastman Kodak, Rochester, New York; and ITEK Corporation, Lexington, Massachusetts. The FCRC effort is performed by Aerospace Corporation, El Segundo, California. Polytechnic Institute, New York, New York is the university contractor.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-2
Program Element: #62301E
DoD Mission Area: 530

Title: Space Surveillance and Advanced Optics
Title: Strategic Technology
Budget Activity: 1. Technology Base

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The High Altitude, Large Optics (HALO) program has continued efforts in the development of technology for future infrared surveillance sensors. The focal plane technology program has demonstrated high performance element arrays of mercury cadmium telluride (HgCdTe) photovoltaic infrared detectors with charge-coupled device (CCD) readout suitable for missile surveillance applications with cut-off infrared wavelength. Average detectivities very close to the maximum theoretically possible have been demonstrated, with these arrays. Longer wavelength, broadband HgCdTe detector arrays have also been fabricated which meet longer range program goals in spectral response, operating temperature and electrical characteristics required for high performance with CCD signal processing and readout. A spectral filter concept with potential for nearly transmission, and with passband characteristics suitable for a number of missions has been evaluated. Development of components for this filter was begun. A programmable brassboard signal processor designed to emulate the critical on-board signal processing hardware functions has been exercised with algorithms to demonstrate background and tracking functions using raw data from the DARPA HI-CAMP measurements program. An optics mirror has demonstrated the feasibility of using mirror segments for development of advanced aspheric figuring techniques and experiments. A intermediate weight, near-term fabrication technology suitable for monolithic mirrors up to about has also been demonstrated. A program to develop a prototype stirling cryorefrigerator was initiated.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The High Altitude, Large Optics program has been restructured as a joint infrared technology development in coordination with the USAF to support decisions in the 1980's on next generation follow-on surveillance systems. Focal plane technology development is continuing in mercury cadmium telluride detector arrays to extend long wavelength response and to increase the dynamic range of readout devices. A element mosaic detector array with response to at least operating at a temperature no lower than will be demonstrated. Development of detector material technology to extend the as far as will continue. Development of alternative spectral filters suitable for the Advanced Warning System (AWS) program will be initiated. The brassboard signal processor

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-2
Program Element: #62301E
DoD Mission Area: 530

Title: Space Surveillance and Advanced Optics
Title: Strategic Technology
Budget Activity: 1. Technology Base

will be used to develop and demonstrate and target track functions for realistic AWS scenarios in conjunction with a mosaic focal plane array. Critical signal processing component requirements to meet on-board reliability and endurance will be finalized and the additional efforts necessary to meet these requirements will be initiated. These will be coordinated with other similar efforts at DARPA, the Services and other Defense Agencies. Advanced optics technology development continues with the completion of spherical figuring of a second mirror segment and of both segments. Development of a prototype Stirling cycle cryorefrigerator will continue. Feasibility of two advanced non-conventional cryorefrigerator concepts will be investigated. In FY 1983, the HALO focal plane technology program will fabricate and demonstrate mercury cadmium telluride mosaic arrays suitable for surveillance and initiate a two-year producibility demonstration of the arrays. Promising new spectral filter efforts to develop concepts compatible with a mosaic sensor concept will be demonstrated. The mirror segments will be mounted and tested as an optically, structurally integrated experiment. This will be the first step to demonstrate the optical and structural requirements for a telescope mirror. This will complete the HALO optics program as presently planned and budgeted. The funding resources have been increased in FY 1983 and FY 1984 to support accelerated development and producibility demonstrations for the USAF/DARPA joint technology program. In FY 1984, performance demonstrations of all key focal plane technologies required for an advanced missile surveillance sensor will be completed and producibility demonstrations of critical components will continue. Demonstration of space structures for large optical sensors will be completed. A prototype Stirling-cycle cryorefrigerator will be demonstrated.

3. Program to Completion: The High Altitude Large Optics program will transfer mature technologies to the USAF Advanced Warning System in Development of technology to further improve and extend infrared surveillance capabilities will continue through

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-2
Program Element: #62301E
DoD Mission Area: 530

Title: Space Surveillance and Advanced Optics
Title: Strategic Technology
Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
<u>High Altitude, Large Optics (HALO)</u>			
o Optics Technology			
Early FY 1981	Early FY 1982	Finish thermal test of glass/composite mirror.	Grinding/polishing delays and budgetary constraints.
--	Mid FY 1982	Complete tests of spherical mirror segments.	New Milestone
Early FY 1982	Early FY 1984	Achieve successful demonstration by deployment of a scale model of the lightweight, optical system technology	Budgetary constraints.
o Focal Plane Technology			
Mid FY 1982	Late FY 1982	Demonstrate element long-wavelength intrinsic focal plane arrays with	Budgetary constraints.
Mid FY 1983	Mid FY 1983	Demonstrate intrinsic focal plane modules with filter and signal processor.	No Change.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 4 T-2
 Program Element: #62301E
 DoD Mission Area: 530

Title: Space Surveillance and Advanced Optics
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Late FY 1983	Demonstrate high throughput spectral filter.	New Milestone.
--	Mid FY 1985	Complete producibility demonstration of element arrays for joint USAF/DARPA technology program.	New Milestone.
o Cryorefrigerator			
	Early FY 1984	Demonstrate prototype Stirling cycle high-efficiency, long-life cryogenic refrigerator.	New Milestone

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Space Surveillance and Advanced Optics	18,953	16,315	20,500	21,000

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-3
Program Element: #62301E
DoD Mission Area: 530

Title: High Energy Laser Technology
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The High Energy Laser Technology project is comprised of the following programs: High Power Visible Lasers; Acquisition Tracking and Pointing; High Power Chemical Lasers; and Laser Optics. The objectives of this project are to develop the basic technologies for improving laser device efficiency, as well as to support advances in laser optical components and ultra-precise beam pointing. The laser device technology efforts are concentrated in two areas:
- G. RELATED ACTIVITIES: This project provides the supporting technology for the major demonstration experiments in PE #62711E (Experimental Evaluation of Major Innovative Technologies), Project Numbers EE-7, EE-8, and EE-12. These three efforts form the DARPA thrust in space defense and constitute
Coordination of this DARPA project with on-going High Energy Laser activities in the Departments of the Army, Navy and Air Force is maintained through periodic reviews with the Director, Directed Energy Programs, Office of the Under Secretary of Defense for Research and Engineering.
- H. WORK PERFORMED BY: 69% of the program is performed by industrial contractors, 13% by National Laboratories, 12% by Federal Contract Research Centers, 4% by Government in-house laboratories, and 2% by universities. Major industrial contractors include: AVCO Everett Research Laboratories, Everett, Massachusetts; Bell Aerospace Corporation, Buffalo, New York; Hughes Aircraft Company, Culver City, California; Martin Marietta Aerospace, Denver, Colorado; Rocketdyne Division of Rockwell International, Canoga Park, California; TRW, Los Angeles, California; National Laboratories (Lawrence Livermore National Laboratory, Livermore, California; and Los Alamos Scientific Laboratories, Los Alamos, New Mexico). Federal Contract Research Centers include the Aerospace Corporation, Los Angeles, California; and MIT Lincoln Laboratory, Lexington, Massachusetts. Government in-house activities are being funded at the Naval Research Laboratory, Washington, D.C.; and the Naval Surface Weapons Center, Silver Spring, Maryland. Universities contributing to the program include Stanford University and the University of Arizona.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-3
Program Element: #62301E
DoD Mission Area: 530

Title: High Energy Laser Technology
Title: Strategic Technology
Budget Activity: 1. Technology Base

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Visible Laser Technology (Short Wavelength Lasers) - In FY 1978,

Acquisition, Tracking and Pointing (ATP) Technology: In this program, the

During 1980, the acquisition and tracking technology base included the evaluation of a technique for rapid acquisition and tracking. Studies conducted in FY 1980 showed that techniques can substantially increase the lethality of laser weapon systems.

In FY 1981, the following actions were accomplished: analysis of handover requirements for

High Power Chemical Laser Technology - Substantial progress has been made in FY 1979 and FY 1980 toward establishing the technology base for a Test results obtained on scaled nozzle arrays have verified that the high fuel efficiency performance data obtained previously with subscale nozzle arrays indeed apply to high-power laser devices. In addition, unconventional

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In FY 1981 laboratory testing of higher order mode and physical optics models of annular resonator performance were validated. In addition, detailed diagnostic measurements of a were performed to provide data to validate laser performance models and to verify the scalability of gain-medium/resonator interactions to the levels.

Laser Optics: - Space optical components and structures have advanced rapidly with the completion (FY 1978) of design studies, theoretical modeling, and structural control development for

The conceptual design was completed (FY 1979) for a diamond tool turning machine to fabricate large laser resonator optics with the precision required for advanced high power devices. A

was also established for large lightweight laser mirrors. In FY 1980, a computer model of a was developed, the final design of the Large Optics Diamond Turning Machine was initiated, and the design of a

The FY 1981 program provided the assessment of a new imaging tracker and completion of the

The development of proceeded through the Conceptual Design Review (CDR) stage into the fabrication of prototypes. The Large Optics Diamond Turning Machine program (LODTM) completed the design of the machine and started construction of the building to house the machine.

Laser/Surface Interactions: This program was initiated in FY 1979 to provide predictive models to describe the interaction of laser radiation with solid materials. It forms the basis for estimating the laser energy required to damage a target. Efforts addressed

Models describing the experimental data in FY 1980. Similar results for the phenomenology governing evaluation of

were developed in FY 1979 and were validated by were obtained in FY 1980 and FY 1981. In addition, was identified, and a preliminary was conducted. For

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2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Visible Lasers - The

Communications program. A in support of the Submarine Laser program to demonstrate the integration of all of the required technologies at will be initiated with two competitive design contracts. Work will begin on operating the The feasibility of the of the modification will be demonstrated by FY 1983. Subsequent to this effort, an average power upgrade will be initiated beginning in FY 1984. Free electron laser experiments which determine the feasibility of high efficiency operation will be completed and accelerator modifications will begin for operation in the visible spectrum in FY 1983. Laboratory experiments to develop the atmospheric turbulence correction necessary for ground based short wavelength laser for anti-satellite (ASAT) will be initiated. In FY 1983, technology development for the space relay mirror, used in conjunction with a high power ground-based visible laser will be initiated with emphasis on long range tracking, precision pointing and The demonstration of the integration of all technologies for high average power, near diffraction limited operation. The output will be converted to the blue-green in FY 1985 for the Submarine Laser Communications program. Free electron laser experiments to demonstrate amplifier efficiencies of at least in the visible spectrum and to demonstrate oscillator efficiencies in excess of is scheduled, using energy recovery techniques for completion in FY 1984. Component development to demonstrate the for the space relay mirror will be underway.

Acquisition Tracking and Pointing (ATP): Activities in FY 1982 will continue in advanced ATP technologies to ensure the development of improved subsystem elements for space applications. Also, additional brassboard activities will be initiated to continue the development of precise, rapid retargeting capabilities. The development of advanced inertial stabilization techniques capable of performance levels exceeding will be initiated. In FY 1983 testing of an advanced inertial reference system brassboard will be conducted. Fire control techniques for will be developed. Scalable beam stabilization techniques will be validated. Fire control techniques for will be developed. The use of NASA/AF-STP "Get-Away-Special" flights as a low cost zero-G test platform will be investigated. In FY 1984, simulator tests of acquisition and tracking subsystems will be performed including the

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surveillance interface. Brassboard tests of an improved pointer with rapid retargeting capability will be conducted. Acquisition, tracking and pointing concepts appropriate for concepts will be identified and component fabrication initiated to establish the feasibility of beam control to

High Power Chemical Lasers: In FY 1982, advanced resonators and performance models for chemical lasers are being investigated in addition to completing testing of new annular laser resonator concepts on CO₂ laser test beds. Gain medium and resonator performance model validation are underway using data acquired with CO₂ test beds and with linear chemical lasers in FY 1981. In FY 1984 the novel resonator development for chemical lasers will be completed. Advances are to continue in improving efficiency and fabricability in small scale nozzle tests and establishing the saturation parameters needed to predict scaling to

Laser Optics: In FY 1982, the second round of development of optical coatings for HEL lasers is being completed. Prototypes of new high performance laser mirrors will be completed and analyses of beam control optics will be extended. The Large Optics Diamond Turning Machine (LODTM) building will be completed and occupied; the machine will be

Efforts to support the LODTM (metrology, metal coatings, and are being initiated. In FY 1983 analysis and modeling efforts will concentrate on the coupled optical-structural performance of the LODE equipment; a program aimed at the actual measurement of vibration inputs on existing HEL's will be initiated. Performance and thermal distortion tests will be completed on newly developed silicon mirrors. The LODTM will be

High power tests of coatings and optical components will be completed and, based on the results obtained, new developments initiated. In FY 1984, the LODTM will be

The development of cooled mirrors will be extended to an improved, optimized design to support LODE and ALPHA requirements. High power testing of newly developed chemical laser optical coatings will be completed and additional development requirements defined. Technology studies of the techniques required for precision optical coatings on optics will be initiated.

Laser/Surface Interactions: In FY 1982, subscale testing will provide data on the coupling of repetitively pulsed In FY 1983 single-pulse experiments

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DoD Mission Area: 530

Title: High Energy Laser Technology
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will be conducted in the range to broaden the range of validity of the data base and the associated predictive models. For CW infrared radiation, subscale simulations with and large-scale tests with high energy lasers will be initiated to determine the vulnerability of
Emphasis will be placed on the failure modes of the
in order to determine the vulnerability under conditions appropriate for Testing will extend into FY 1983 after which the feasibility of hardening concepts will be addressed.

3. Program to Completion: Visible Lasers - The critical elements for demonstrating high average power

Hardware development will be initiated for demonstration of and technology development for Large space-based mirror technology and optics development for atmospheric turbulence compensation will be continued. An experiment to demonstrate the feasibility of compensation is planned for The elements for long range acquisition, tracking and pointing systems will continue to be developed for the ground-based, short wavelength laser to establish the feasibility of

Chemical Lasers - This portion of the program will continue technology developments to establish feasibility of chemical lasers by detailed analysis and testing of suitable components and resonator concepts. It will also demonstrate the feasibility of manufacturing the unique annular resonator components up to in diameter. In Laser Optics, large space-based mirrors and the adaptive beam control technologies will be developed to maintain options for advanced space application in the The elements required for advanced Acquisition Tracking and Pointing systems will continue to be developed for both in-space chemical laser beams and ground-based short wavelength laser beams to establish feasibility of beam control with stability. These are all continuing programs forming the technology base for more advanced experimental demonstration programs. In Laser/Surface Interactions, attention will shift from the vulnerability and hardening of to the vulnerability and hardening of predictive models based upon subscale and scaled experiments will have been generated, and will be available for use in laser effectiveness analyses.

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Project: #ST-3
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DoD Mission Area: 530

Title: High Energy Laser Technology
Title: Strategic Technology
Budget Activity: 1. Technology Base

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1983	Mid FY 1983		No change.
Early FY 1982	Early FY 1984	Demonstrate High Efficiency Free Electron Laser	Program changed to demonstrate performance as an oscillator.
--		Validated estimates of vulner- ability of	New milestone.
Mid FY 1983	Late FY 1983		Reduced Funding Profile.
Mid FY 1984			Restructured program to demonstrate pulsed power before committing to modification.

5. Resources: (\$ in Thousands)

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Project: #ST-3
 Program Element: #62301E
 DoD Mission Area: 530

Title: High Energy Laser Technology
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
High Energy Laser Technology	23,063	46,557	44,700	59,800

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-4
Program Element: #62301E
DoD Mission Area: 530

Title: Strategic Deterrent
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The Strategic Deterrent Project consists of three main activities oriented toward investigating new technical approaches to offensive and defensive weapons: Unconventional Defense Technology, the Ballistic Intercept Missile, and Strategic Weapons Technology. An effort toward development of Advanced Strategic Submersible Technology was a part of this program thru FY 1980. The Unconventional Defense Technology efforts are structured to address: (1) Contribution of high payoff surveillance techniques to defend against; (2) Measures to increase the survivability of U.S. Satellites; (3) A Space Cruiser for operations; and (4) , repair of U.S. spacecraft and emergency rescue , strategic weapons that destroy targets by . The Ballistic Intercept Missile is directed at providing a ballistic weapon that can kill . The weapon is a system with target. The . The Strategic Weapons Technology program is concentrating on two areas: (1) Options that will provide for strategic weapons after they have been launched; and (2) the development of a technique for suppression of so that strategic aircraft can achieve in shorter time and can increase their unrefueled range.
- G. RELATED ACTIVITIES: This work is directly related to programs of the Army Ballistic Missile Defense Office, the Air Force Space Division, the Air Force Aeronautical Systems Division, the Air Force Ballistic Missile Office, the Naval Surface Weapons Center, and the Naval Undersea Systems Center.
- H. WORK PERFORMED BY: About ninety percent of the effort is conducted by private industry. The major contractors are: General Dynamics, San Diego, California; General Research Corporation, Santa Barbara, California; Rand Corporation, Santa Monica, California; Analytic Services Company, Arlington, Virginia; Hughes, Fullerton, California; Raytheon, Lexington, Massachusetts; Stanford Research Institute, Menlo Park, California; Lockheed Missiles and Space Company, Palo Alto, California; Rockwell International, Downey, California; and Vehicle Research Corporation, South Pasadena, California. The remaining ten percent is conducted by the Department of Energy Sandia National Laboratories, Albuquerque, New Mexico, and the Naval Surface Weapons Center, Dahlgren, Virginia.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-4
Program Element: #62301E
DoD Mission Area: 530

Title: Strategic Deterrent
Title: Strategic Technology
Budget Activity: 1. Technology Base

1. FY 1981 and Prior Accomplishments: In the Unconventional Defense Technology program, several efforts matured to the point that they were transferred to other areas or were considered complete. An analysis was completed of the concepts for a to relay ground or space-based to support missions such as:

. The effort showed its greatest promise in submarine laser communications and is described in Project ST-9. Experiments were completed involving the facility at Maui, Hawaii to evaluate the capability of algorithms to provide highly accurate

. Tests against a demonstrated that the technique could be used in the . That technology was included in a new effort -- the task. This task was initiated to examine potential contributions of DARPA surveillance and weapons technology, to NATO defense against . Emphasis is on the

. The space cruiser program was initiated to define a single man, small space vehicle to perform missions that require large excursions in space. The Department of Energy's, Sandia National Laboratory was selected for cruiser design analysis, wind tunnel testing, etc of the basic vehicle -- a concept using a Sandia vehicle design. Technology issues in life support, guidance/avionics and propulsion are being examined. A joint program was initiated with the Air Force Ballistic Missile Office for the Impactor Technology Program. This effort included a development; and continues in FY 1982 with additional complementing efforts. A joint program was initiated with the Worldwide Military Command and Control Systems Engineer to define the options for providing an enduring, space-based missile warning system that will be available a minimum of after the initiation of a strategic nuclear war. Also, investigations were started on applications of a which would be integrated into various geosynchronous satellites to increase their survivability. This effort was begun as a special excursion from previous work to evaluate on-orbit defenders. All efforts under the Advanced Strategic Submersibles Technology program were terminated in FY 1980. It was determined that further DARPA involvement in technology developments in these areas was not necessary. The Ballistic Intercept Missile program was initiated in FY 1980. During this period three competitive analyses were completed which identified radically different

and confirming the DARPA objective for a weapon . In FY 1981, the three efforts transitioned into a competitive detailed design for future selection of the optimum configuration for hardware

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DoD Mission Area: 530

Title: Strategic Deterrent
Title: Strategic Technology
Budget Activity: 1. Technology Base

development and test. Efforts were started to reassess overall system performance through simulations as designs matured.

The Strategic Weapons Technology program was initiated in FY 1981 for two purposes: (1) To evaluate options for strategic weapons. This effort focused on the feasibility of combining a Minuteman III booster and a that could ; (2) To evaluate a technique for the elimination of on supersonic aircraft. The effort includes theoretical modeling and limited wind tunnel tests.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In FY 1982, under the Unconventional Defense Technology program, five efforts are being pursued. The Space Cruiser design effort will be completed and areas requiring subsystems technology development identified. Surveillance options are being defined for

. The Impactor Technology Program is augmented -- jointly with the Air Force -- with efforts in: total system definition; assessments. developments for the ground tests of will commence. Program will enter into the limited test phase; tests will be conducted against simulated targets; will be evaluated for survival at and systems definition efforts will be continued.

Under the FY 1982 Ballistic Intercept Missile program, the three detailed designs are continued. Total system performance is being determined analytically for each design. Integration issues including interactions, prime power supplies, interfaces, and compatibility with the Navy's Vertical Launching System are being addressed. An independent, government led team is established to critically assess the designs.

For the Strategic Weapons Technology program, data from the wind tunnel tests and analysis will be fed into a performance model. Appraisals will be made on overall vehicle performance. Based on the results of these tasks, a limited decision will be made whether to conduct further design evaluations to identify various bomber configurations that would make use of the technique. The Strategic assessment is being completed and additional areas for refinement are being identified.

FY 1983 R&D DESCRIPTIVE SUMMARY

Project: #ST-4
Program Element: #62301E
DoD Mission Area: 530

Title: Strategic Deterrent
Title: Strategic Technology
Budget Activity: 1. Technology Base

In FY 1983 under Unconventional Defense Technology, the Impactor Technology program will continue with testing as well as total system design assessments. This program will transition to the Air Force completely in FY 1984. The results of the Space Cruiser and efforts will transition to the Air Force Space Division and Army Ballistic Missile Defense Office respectively. Limited assessment of survivable missile surveillance will continue in FY 1983. A selection will be made among the competing designs for the Ballistic Intercept Missile and efforts begun for captive flight testing of the subsystem by the end of FY 1985. The significant funding increase from FY 1983 to 1984 is principally due to evolution of Ballistic Intercept Missile efforts to hardware design and fabrication for the captive flight test.

3. Program to Completion: This is a continuing program. The Unconventional Defense Technology efforts will continue to explore new technologies for advanced strategic defensive applications. The Ballistic Intercept Missile program will complete the development of techniques and captive flight testing. A series of flight test demonstrations will be considered for the FY 1987 - FY 1988 time frame. Efforts in Strategic Weapons Technology will be evaluated for further technological development.

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1981	Mid FY 1983	Preliminary design review for BIM concept.	Revised funding priorities within the USAF forced program restructuring.
--	Mid FY 1984	Transition Impactor Technology to Air Force.	New Milestone.
Late FY 1982	Early FY 1985	Complete integration. (for captive flight testing)	Limitations on funding.

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Project: #ST-4
 Program Element: #62301E
 DoD Mission Area: 530

Title: Strategic Deterrent
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1983	Late FY 1985	demonstration completed. (for captive flight tests)	Limitations on funding.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Strategic Deterrent	3,933	7,767	9,500	20,500

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-5
Program Element: #62301E
DoD Mission Area: 530

Title: Strategic Delivery Vehicles
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop technologies appropriate to improved strategic delivery vehicles. There are four major areas currently under investigation. The Advanced Delivery Systems Program is investigating unconventional design and launch modes along with a variety of synergistic subsystem technologies in order to provide substantial increases in the range-payload product simultaneously with an improved penetration capability. The Autonomous Terminal Homing Program is developing the precise guidance techniques which will enable the effective destruction of broad classes of fixed, high value targets with non-nuclear munitions thereby providing the National Command Authority with response options which are alternatives to massive nuclear destruction. Included in this effort is an optimal flight path project for allowing the vehicles to avoid known and unknown radar threats and to proceed to the target with the greatest possible chance of survival. The Advanced Cruise Missile Engine Program is developing a high payoff engine concept which promises a potential to utilize new high energy fuels, increased thrust and a reduction in fuel consumption of compared to the current cruise missile (CM) engine (F-107) thus permitting smaller vehicles to be developed or more payload-range combination for advanced mission options. Finally, the Cruise Missile Detection Technology Program is investigating the observable phenomenology and characterizing and assessing potential CM defense technologies in order to provide advanced CM technology development programs with insight into methods of defeating defenses, and to provide a field experimentation capability to realistically evaluate and demonstrate the survivability of such advanced missiles.
- G. RELATED ACTIVITIES: The Advanced Delivery System is directly related to programs managed by the Joint Cruise Missile Project Office, and by the Air Force Aeronautical Systems Division, Deputy for Strategic Systems and Deputy for Development Planning (the latter serving as DARPA's agent). The Autonomous Terminal Homing effort is related to the Army's Pershing II developments and the Air Force's Advanced Ballistic Reentry Systems (ABRES). The Advanced Cruise Missile Engine activities are related to small engine activities of the Army Tank and Automotive R&D Command, the Air Force Aero Propulsion Laboratory at (Wright-Patterson AFB serving as DARPA's agent) and the Naval Air Propulsion Center (NAPC Trenton, NJ, serving as a DARPA agent). The Cruise Missile Detection Technology Program (CMDT) interfaces with the Joint Cruise Missile Project Office, the Air Force Test and Evaluation Center, the Strategic Air Command, the air defense and detection activities at the Army Missile R&D Command, the Air Force Avionics Laboratory, Rome Air Development Center, and Electronic Systems Division (which serves as the DARPA agent for the CMDT Program).

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Project: #ST-5
Program Element: #62301E
DoD Mission Area: 530

Title: Strategic Delivery Vehicles
Title: Strategic Technology
Budget Activity: 1. Technology Base

H. WORK PERFORMED BY: Industry provides 98% and government in-house 2% of this project effort. The industrial contractors are: Vought Corporation, Dallas, Texas; Convair Division of General Dynamics, San Diego, California; Air Research Manufacturing Company, Phoenix, Arizona; Honeywell Electro-Optics Center, Lexington, Massachusetts; Raytheon Corporation, Sudbury, Massachusetts; SCIPAR Corporation, Buffalo, New York; Systems Control Technology, Palo Alto, California; the Analytic Sciences Corporation, Reading, Massachusetts; Control Data Corporation, Minneapolis, Minnesota; Technology Services Corporation, Santa Monica, California; Northrop Corporation, Ventura, California; Teledyne Continental Engine, Toledo, Ohio; Williams International, Walled Lake, Michigan; General Power Corporation, Paoli, Pennsylvania; SPC Corporation, Arlington, Virginia; Straford Research Institute, Menlo Park, California; Calspan Corporation, Buffalo, New York; Systems Control, Inc., Palo Alto, California; Goodyear Aerospace Corporation, Akron, Ohio; Grumman Aerospace, Bethpage, New York; Rockwell International, Anaheim, California; BDM Corporation, McLean, Virginia; and the MIT Lincoln Laboratory, Lexington, Massachusetts. The government in-house work is performed by USAF Space Division, El Segundo, California and the Naval Surface Weapons Center, Dahlgren, Virginia.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: In FY 1977, the Advanced Delivery Systems Program initiated two parallel studies by major airframe contractors of advanced concepts that can overcome the two ultimate limitations of first generation cruise missiles (CMs), i.e., questionable survivability with respect to potential future responsive Soviet defense improvements and constrained range-payload products which preclude promising options such as advanced non-nuclear theater warhead alternatives. In FY 1978 the two contracted efforts began developing the critical technologies required for the next generation CMs. In FY 1979 the critical technologies program concluded with refined scale model wind tunnel tests, inlet and nozzle development and test, full-scale Radar Cross Section (RCS) measurements, critical component structural tests and infrared (IR) measurements.

In FY 1980, activities under this program included investigation of techniques to greatly increase range and the development of a Cruise Missile (CM) optimal flight path system, techniques for CM cost reduction, an employment concept for non-nuclear CMs and a formulation of the requirements for a dispenser and penetrator munition.

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Project: #ST-5
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DoD Mission Area: 530

Title: Strategic Delivery Vehicles
Title: Strategic Technology
Budget Activity: 1. Technology Base

In FY 1981, a mid-range vehicle program initiated the transfer of technology to the Air Force through a jointly funded vehicle technology demonstration program and merged this effort with Air Force Program Element 63319F, Advanced Cruise Missile Technology. This joint vehicle technology demonstration program will carry one contractor for an approximate three year flight demonstration phase. Work continued on the non-nuclear CM with conceptual designs for dispenser and penetrator munitions. Efforts in stealthy terrain following, terrain/obstacle avoidance continued, together with bomb damage assessment system development. Work continued on a long-range vehicles program to define the concept(s) and configurations(s) having the greatest potential for further development. Candidate concepts and configurations were formulated by defining an applicable technology base including propulsion, observables, structures, guidance and control, and other critical technologies. Configurations include low observable shapes and design approaches suggested in other DARPA studies in addition to those identified by the contractors. Qualitative assessment of configuration characteristics and basing concepts provided a basis from which the contractors will select range and payload weight combinations and associated designs. In FY 1975 and FY 1976, the Autonomous Terminal Homing Program investigated the broad spectrum of technical issues for self-contained guidance systems providing Circular Error of Probabilities (CEPs) at impact of under adverse weather conditions when viewing targets from a low altitude CM. These studies led to the initiation in FY 1977 of the development of key technologies in areas related to self-contained guidance systems.

calibrated imagery were collected and analyzed for assessment of the impact of possible sensor characteristics. Performance sensitivities of alternative advanced scene-matching techniques were quantified using these target signature data. This led to the selection of two sensors and two matcher schemes for brassboard development. Accomplishments during FY 1981 included the fabrication of two brassboard sensors, an 8-12 micron passive and a 10.6 micron active coherent laser imager, the design of two advanced scene matching processors, refinement of synthetic reference preparation techniques, development of advanced terrain following/obstacle avoidance algorithms and preparation of a Scene Matching Laboratory for evaluation of integrated guidance system performance. In addition, detailed flight test plans were formulated and preparations made for an extensive sensor image data collection effort during FY 1982. The Advanced Cruise Missile Engine Program was initiated in FY 1977 with a study to assess the feasibility of several engine concepts. Technologies critical to a Compound Cycle Turbofan Engine (CCTE) were initiated in FY 1978. This CCTE concept replaced the combustor of a typical turbofan with a two stroke, high speed (8000 RPM) diesel engine. The design and fabrication of test apparatus to develop the critical technologies of the high speed diesel core engine were conducted. The

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feasibility of an Excentric turbofan engine concept was also initiated in FY 1978. The concept proposes a high overall pressure ratio of 36 (compared with 11 for the F107) and a turbine temperature of 2500°F for the uncooled turbine blades. The Excentric is a 3 spool turbofan with the third spool mounted off axis to the other two spools. In FY 1979 the Compound Cycle Turbofan Engine (CCTE) single cylinder test rig was demonstrated at 8000 RPM (133 injections per second). The design of the Excentric engine third spool was completed and the fabrication started. Design and materials analysis resulted in using Columbian and ceramic turbine blades which will permit uncooled operation of 2500°F turbine inlet temperature. In FY 1981 The CCTE completed the development and testing of the single cylinder test rig. A refined lower block assembly was fabricated to permit pressurization (to prevent oil boil-off), high temperatures and port arrangements fine tuning (for improved breathing and scavenging). The CCTE single-cylinder testing was demonstrated at 1700 RPM + 116 indicated horsepower. The Excentric 3rd spool was tested with a Waspalloy turbine at 1900°F to fine tune the compressor and turbine for peak efficiency. The fabrication of the coated Columbian and ceramic turbine blades was completed. Initial DARPA funding of a carbon-carbon recuperative engine initiated a feasibility investigation. Initial DARPA funding of a wave rotor initiated a proof-of-concept test. The Cruise Missile Detection Technology Program was initiated in mid-FY 1978 to analyze the basic survivability issues with respect to advanced SAMs, airborne interceptors, Soviet AWACS, and unconventional defenses that could be "tuned" to the cruise missile threat. Initiation of radar clutter data collection was effected late in FY 1979 and much of the SAM and manned interceptor modeling was completed. In FY 1980 an X-band radar clutter collection effort surveyed over 70 sites in central Canada and north-central U.S. as a precursor activity to a five frequency clutter collection effort. Airborne clutter collection and analysis as well as multipath and diffraction measurement efforts were initiated and have shown marked progress. In FY 1981 detailed analysis of the collected X-band ground based radar clutter data was begun. This analyzed data was combined with "ground truth" terrain descriptions to enable us to model expected clutter returns from specific terrain types and terrain cover. This integrated modeling approach was applied to

clutter at the

Additionally, the X-band clutter equipment was used to measure
This clutter data was used to assist in the

Also, through the data base established

Late in FY 1981 the five frequency clutter collection equipment was delivered and integrated tests begun. Also, an L-, X-band counter-battery radar was GFE'd from the U.S. Marine Corps to the CMTD program to undergo modifications as the first instrumentation for flight test demonstration activities.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-5
Program Element: #62301E
DoD Mission Area: 530

Title: Strategic Delivery Vehicles
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2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In FY 1982, the Advanced Delivery Systems Program will transition to AF and will continue as an AF vehicle technology demonstration program. The long range vehicle technology program will complete the design study begun in FY 1981. After evaluation of competing concepts this program will proceed into the development and test of the critical technologies required for the long range mission. These tests will include scale model wind tunnel tests, inlet and nozzle development and test, Radar Cross Section (RCS) measurements, critical component structural test, propulsion integration, infrared (IR) measurements and optimal flight path sensor development. Construction of the two imaging sensors for the Autonomous Terminal Homing (ATH) Program will be completed early in FY 1982 and flight testing, in dual pod mounted configurations, will begin. The one year flight test/data collection effort will extend into FY 1983. Development of the two competing scene matching algorithms will be completed and emulations delivered to the Scene Matching Laboratory where processing of flight test imagery with synthetic references will begin. Extensive evaluation of terrain following/obstacle avoidance (TF/OA) techniques will be carried out using the simulation facility developed in FY 1981 and performance tradeoffs examined to determine the best approach for development in conjunction with ATH. At the end of FY 1982, two promising damage assessment algorithm approaches (important growth options) will be selected for development during FY 1983. In FY 1982, the Advanced Cruise Missile Engine Program will proceed with the design and fabrication of an integrated engine. A decision whether to proceed with both the CCTE and Excentric Engine concept or to proceed with only one of these concepts will be made. The feasibility investigation of the recuperative engine and the wave turbine engine will continue. The recuperative engine program will select an initial design utilizing the carbon-carbon technology. The wave turbine will complete proof of concept tests and a decision to continue investigation will be made. In FY 1982, the Cruise Missile Detection Technology Program (CMDT) will continue acquiring and employing the necessary field instrumentation equipment and experimental programs required to perform fundamental measurements. A multi-frequency (VHF, UHF, L-, S- and X-Band) radar system will visit 30 to 40 of the over 70 sites visited by the X-band radar to quantify the Moving Target Indicator (MTI) requirements necessary to cope with clutter. As data are collected and analyzed in the CMDT continuing feedback to the advanced delivery vehicle, contractors will provide for the earliest possible design improvements to be made in order to maximize cruise missile (CM) survivability.

The output of this effort will be parameterized for such effects as CM radar cross section (RCS), CM altitude, Comparable predictions will be made for Detailed

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systems studies and, in some more promising cases, design studies will be made to evaluate in detail the viable "tuned" anti-CM defensive systems.

Activities on three specific new instrumentation systems will begin in FY 1982 and continue through the out years (a low frequency (VHF) ground-based surveillance radar, an X-band medium/high PRF ground-based radar, the CMDT, the multi-frequency radar collection equipment will collect data from a very large group of sites In As this collection progresses, the actual data collected will be used to develop and verify engineering models of the clutter and propagation phenomenology. The collection, analysis and modeling in the infrared phenomenology will also continue, aiming at flight test demonstration in late FY 1982.

In FY 1983, the Advanced Delivery System Program feasibility demonstration and testing begun in FY 1982, will continue. Refinement in the development of the critical technologies will include wind tunnel test, unique engine installations, improved control concepts and critical subsystem development, such as tests of the structural characteristics of Supporting engineering and effectiveness analyses will include tradeoffs between aero and propulsion performance and survivability in the basing, cruise and penetration phases of the flight profile. In the Autonomous Terminal Homing (ATH) Program, flight test data collection will be completed by mid FY 1983. ATH performance estimates from the Scene Matching Laboratory and cruise missile compatible sensor/processor designs will be evaluated by the end of FY 1983 and a single sensor/scene matcher selected for continued development and free flight demonstration. Detailed design of an operational reference preparation workstation will be completed. Terrain Following/Obstacle Avoidance (TF/OA) sensor/processor design requirements will be finalized and a decision to either integrate ATH and TF/OA or to pursue separate TF/OA development will be made. The capabilities of the two damage assessment approaches will be assessed and a single approach (consistent with the sensor chosen for ATH) will be selected for detailed design in FY 1984.

In FY 1983, The Advanced Cruise Missile Engine Program will continue the design and fabrication of a integrated CCTE and/or Excentric engine. The recuperative engine will continue with a feasibility demonstration of the regenerative cycle. The wave turbine, if successful in proof-of-concept test, will continue in concept

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formulation. The Cruise Missile Detection Technology Program will continue the collection and analysis of multifrequency radar clutter. Both radar and IR propagation phenomenology will be collected and analyzed throughout this period. Delivery of a VHF instrumentation radar as a part of the flight test verification equipment will take place. Initial testing of this equipment will begin in FY 1983 against appropriate flight test vehicles.

In FY 1984, the long-range vehicle program will conclude the feasibility demonstration and test and will transition to an advanced development phase. During this phase a prototype vehicle will be fabricated integrating the various airframe, propulsion and avionic systems previously developed and tested. This advanced development phase is projected to be a 36 month effort concluding, in FY 1987. The Autonomous Terminal Homing (ATH) Program will begin design of a flight demonstration integrated guidance unit (sensor and scene matching processor). Hardware integration and software development for an operational reference preparation work-station will be initiated. A detailed design of a laser-compatible Terrain Following/Obstacle Avoidance (TF/OA) processor will be developed in preparation for prototype development in FY 1985 and processor options for damage assessment determined (design of a separate processor for damage assessment will only be pursued if the damage assessment algorithms cannot be made compatible with the ATH processor).

In FY 1984 the CCTE/Excentric engine will complete a integrated engine demonstration and validation with a demonstrated thrust specific fuel consumption reduction relative to the current F107 turbofan engine. The feasibility demonstration of the recuperative engine will be completed with a decision of whether to proceed with an integrated engine demonstration. The wave turbine will continue in concept formulation.

In FY 1984, in the Cruise Missile Detection Technology Program, the five frequency radar phenomenological data collection will be concluded by the end of the fiscal year. It will culminate in a final phenomenological model that will be demonstrated in the out years. Construction of both the surveillance radar and the equipment will begin. The tests, measurements, and analyses needed to develop verified engineering models of the key phenomena affecting the survivability/penetrativity of cruise missiles will be performed. These results are critical to the confident determination of future missile force missions, structure and effectiveness.

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3. Program to Completion: In the Advanced Delivery Systems Program high risk/high payoff technologies applicable to air vehicle surveillance, advance air defense, and high survivability/penetrativity of strategic air vehicles will be pursued through research, development and critical technology demonstration.

DARPA participation in the long-range vehicle program will subside in FY 1987/FY 1988 as the program is transitioned to the services for continuation of the advanced development phase and entry into a full scale development phase. In the Advanced Cruise Missile Engine Program, the CCTE/Excentric engine will proceed into an advanced development phase in which a prototype engine will be fabricated. It is anticipated that the engine technology will have matured to the point that the transfer to one of the services would be appropriate. The recuperative engine, if successful in the integrated engine demonstration, will proceed into an advanced development phase. It is anticipated the program would be transitioned to one of the services at this time. The wave turbine would complete the integrated engine demonstration and if successful would proceed with an advanced development phase.

The Autonomous Terminal Homing (ATH) Program will experimentally demonstrate the feasibility of self-contained, adverse weather guidance systems of sufficient precision to offer a radical enhancement of the options available to the National Command Authority. The use of precise non-nuclear munitions against long-range, fixed, high value targets (e.g., historically nuclear theater missions) would provide a more credible deterrent since nuclear release authority would no longer be an issue. Limiting damage also provides our policy makers with additional strategic responses, and thus deterrence against a much broader spectrum of situations. The program will also demonstrate a Terrain Following/Obstacle Avoidance capability and a bomb damage assessment capability. The former capability will greatly enhance cruise missile survivability, while the latter will eliminate the necessity to expend cruise missiles on previously destroyed targets. The Cruise Missile Detection Technology Program will perform the analyses, measurements and tests needed to develop verified engineering models of the key issues affecting survivability/penetrativity of cruise missiles. These results are critical to the confident determination of future missile force missions, structure, and effectiveness.

Further, the resulting understanding of potential weaknesses in advanced defenses will provide essential direction to our development of second generation missiles. State-of-the-art transportable instrumentation (Radar, IR and acoustic) will be operated at various U.S. test ranges to demonstrate survivability rates of U.S. cruise

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missiles and other U.S. air vehicles. Extremely well instrumented data will allow designers and operational planners to assess current and future potential enemy defensive systems capabilities against our delivery vehicles. It will greatly assist these planners in maximizing our weapons-systems effectiveness in the face of responsive defense systems. Continual feedback to our cruise missile designers will help assure maximum response to potential defensive threats as well as maximum use of phenomena that assist penetrativity. The equipment used to collect the basic phenomenological data will be adapted for test range use for flight test verification. At the end of FY 1985 the effort should transition to the official service test range entity (currently USAF Test and Evaluation Center of AFCS).

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Advanced Delivery Systems:			
--	Early FY 82	Transfer to AF of Mid-range vehicle technology and flight demonstration program with one contractor.	New Milestone
--	Early FY 82	Completion of concept design studies for long-range vehicle.	New Milestone
--	Mid FY 1982	Initiation of propulsion, materials, avionics, structural and RCS technology feasibility demonstration and test program.	New Milestone

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Late FY 1983	Evaluate technology efforts above and preliminary design, completion of the feasibility demonstration and test programs.	New Milestone
--	Late FY 1983	Major decision to proceed with advanced development phase	New Milestone
--	Late FY 1984	Initiation of an advanced development phase with the fabrication of a proto-type long range vehicle.	New Milestone
--	FY 1987	Flight demonstration of a proto-type long-range vehicle.	New Milestone

Cruise Missile Detection Technology Program:

Mid FY 1982	Late FY 1982	Begin flight demo with calibrated radar and IR instrumentation.	Delay in decision and funding delayed acquisition process
--	Early FY 1982	Begin multi-frequency groundbased radar clutter collection.	New Milestone
--	Early FY 1982	Specification and acquisition of VHF Surveillance Radar.	New Milestone

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Mid FY 1982	Specification of X-Band Medium/ High PRF Radar.	New Milestone
--	Mid FY 1982		New Milestone
Mid FY 1982	Mid FY 1982	Acceptance testing of low alti- tude aircraft measurement system.	No Change.
Mid FY 1982	Mid FY 1982	Begin flight demonstration with calibrated radar and IR instru- mentation.	No Change.
--	Late FY 1982	Produce preliminary five fre- quency clutter model.	New Milestone.
--	Mid FY 1983	Specification of low frequency (VHF and UHF) surveillance radar.	New Milestone.
--	Mid FY 1983		New Milestone.
--	Late FY 1984	Produce final five frequency models.	New Milestone.

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Thru FY 1985	Flight test verification performance and analysis.	New Milestone.
--	Late FY 1985	Transition program to official U.S. test entity (currently AFTEC).	New milestone.

Autonomous Terminal Homing (ATH) Program

--	Early FY 1982	Complete fabrication of brass-board imaging sensors.	New Submission
--	Mid FY 1983	Complete brassboard sensor flight testing.	New Submissions
--	Late FY 1983	Select single sensor/scene matcher combination.	New Submission
--	Late FY 1983	Select TF/OA and damage assessment design approaches.	New Submission
--	Mid FY 1984	Complete integrated guidance unit design.	New Submission
--	Mid FY 1985	Complete integrated guidance unit fabrication	New Submission

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Early FY 1986	Complete IGU/Cruise Missile Integration	New Submission
--	Late FY 1986	Complete captive flight test.	New Submission
--	End FY 1987	Complete free flight demonstration.	New Submission
<u>Advanced Cruise Missile Engine</u>			
--	Early FY 1982	Initiation of Design of Excentric Engine (CCTE/Excentric).	New integrated Engine
--	Late FY 1981	Initiation of feasibility of Recuperative Engine	New investigation
--	Mid FY 1982	Initiation of design of engine using carbon-carbon technology.	New recuperative engine.
--	Mid FY 1984	Complete integrated engine (CCTE/Excentric).	New demonstration
--	Mid FY 1984	Complete feasibility Recuperative engine.	New demonstration

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Early FY85	Start of Advanced Development Phase (CCTE/Excentric).	New Milestone.
Early FY 1984	Mid FY 1985	Complete flight tests.	Follows from previous milestone changes and rescope of Flight Test Phase.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Strategic Delivery Vehicles	33,162	30,650	27,200	31,800

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Project: #ST-6
Program Element: #62301E
DoD Mission Area: 530

Title: Warning Technology
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The Warning Technology Project consists of two main project areas: Infrared (IR) Early Warning and Detection from Space. IR Early Warning is structured to determine the IR signatures of: (1) intercontinental and submarine launched ballistic missiles using both conventional and (2) strategic aircraft and cruise missiles; (3) and (4) the natural and perturbed backgrounds against which these targets are observed from a spaceborne IR surveillance sensor. This program will provide the data base for the design of advanced space surveillance systems and will guide the development of the technology base. Detection from Space consists of the development of core technology for space-based radar concepts at including radars and space-fed lens phased-arrays resistant to physical attack. Mission applications analogous to those examined for IR sensors will be assessed.
- G. RELATED ACTIVITIES: These efforts are directly related to programs of the Under Secretary of Defense for Research and Engineering; Assistant Secretary of Defense (C3I); Air Force - Directorate of Space Systems and Command, Control, Communications (Jointly Funded Program), Aeronautical Systems Division (Jointly Funded Program) Rome Air Development Center, USAF Space Division, Rocket Propulsion Laboratory, Geophysics Laboratory and Avionics Laboratory; Army -Missile Research and Development Command and Harry Diamond Laboratories; and Navy - Naval Weapons Center, Naval Research Laboratory, Naval Electronics Systems Command and Naval Postgraduate School. The Detection from Space effort involves joint funding with Air Force and NASA organizations. Service funding supports approximately twenty-five percent of this effort.
- H. WORK PERFORMED BY: Ninety-five percent of this work is performed by industry and five percent by Government laboratories. Major industrial contractors are: Hughes Aircraft, Culver City, California; Lockheed Missiles and Space Company, Palo Alto, California; Rockwell International, Seal Beach and Thousand Oaks, California; Grumman Aerospace, Bethpage, New York; Raytheon Corporation, Bedford, Massachusetts; Environmental Research Institute of Michigan, Ann Arbor, Michigan; General Research Corporation, Santa Barbara, California; Texas Instruments, Dallas, Texas; General Electric, Syracuse, New York; Draper Laboratories, Cambridge, Massachusetts; General Dynamics, San Diego, California; Ball Aerospace Systems Division, Boulder, Colorado; Photon Research Associates, Inc., La Jolla, California; R&D Associates, Marina del Rey, California; SRI, International, Menlo Park, California; Calspan Corporation, Buffalo, New York; ESL, Incorporated, Sunnyvale, California; Syracuse Research Center, Syracuse, New

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York; Westinghouse, Baltimore, Maryland; and Hazeltine Corporation, Long Island, New York. Government laboratories participating include: Air Force Geophysics Laboratory, Hanscom Air Force Base, Massachusetts; Rome Air Development Center, Griffiss Air Force Base, New York; Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, California; Naval Research Laboratory, Washington, DC; and Naval Postgraduate School, Monterey, California. Federal Contract Research Center support includes: Aerospace Corporation, El Segundo, California; and Institute for Defense Analyses, Arlington, Virginia.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The HI-CAMP I sensor is an advanced airborne infrared measurements instrument which has made over 20 data collections of high resolution (spectral, spatial, and temporal), two-dimensional measurements of earth backgrounds and mobile and stationary air, sea, and land targets. The infrared spectrum from has been measured in the shortwave infrared (SWIR) and longwave infrared (LWIR) regions by use of various spectral filters, circularly variable filter (CVF) and a tilt tuned etalon. The HI-CAMP I sensor was the first field demonstration of the element, two-dimensional monolithic infrared mosaic detector arrays with charge coupled-device (CCD) multiplexers developed under this project. The HI-CAMP sensor made a significant breakthrough by demonstrating in FY 1980 the first detection of the with a mosaic sensor against a cluttered infrared background scene employing the TEAL RUBY tracking algorithm. The uncalibrated data are typical of data input to the on-board processor of an operational system and similar results were obtained using the advanced algorithms of the HALO signal processor breadboard.

This project is also investigating jointly with the USAF, target signatures for advanced missiles and tactical vehicles through a laboratory measurements program. Uncertainties, as high as a factor of infrared signatures have been identified, causing significant uncertainty in optimized advanced system design. Cloud statistics for the eastern and western hemispheres have been compiled to evaluate the impact of meteorology on the design of spaceborne infrared surveillance and laser systems. Two handbooks of strategic missile signatures were compiled as the source information for advanced surveillance programs such as the DARPA Advanced Sensor Demonstration Program and the USAF Advanced Warning System Program. The Mt St. Helens' eruptions were analyzed as an analog to and it was found

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that a could have significant effects on aircraft engines and electrooptical systems. These results led to an Air Force studies and analysis initiative, a DNA program of Foreign Damage to aircraft engines and detailed investigation of impact on surveillance systems. Advanced millimeter wave mosaic receiver approaches were evaluated for all weather passive surveillance of military targets and found to offer some potential for space-based surveillance. A technology effort was initiated for multi-mission space-based radars that detect and track strategic air vehicles. Efforts were continued in the following areas: low cost (less than \$10), lightweight transceiver modules; sensor utility tradeoffs; antenna membrane development and test; structural analyses of antenna concepts; and concept development. Structural dynamics and thermal tests were successfully completed on a membrane antenna test article. A second, smaller test article was built for passively simulating the RF characteristics closely. The development of both silicon and gallium arsenide transceiver modules is continuing in the second phase. Monolithic power amplifier, low noise amplifier, phase shifter and RF switch components have been fabricated and demonstrated to meet most of the original development goals. Transfer to a large variety of military microwave systems besides space-based radar is occurring already.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The HI-CAMP II sensor is being designed and fabricated and will consist of a new focal plane, improved optics and electronics, a correlation tracker for low contrast targets and compatibility with the ER-1 U-2 aircraft. This sensor will be mounted on a new gimbal system for long atmospheric slant path measurements of military targets, will be capable of night operations and will measure targets not measurable with the HI-CAMP I sensor. Test flights will be completed by the end of FY 1983 and the system will be ready to support the TEAL RUBY Space Experiment in FY 1984. Laboratory measurements of missile radiating species of rocket propellants will be completed and missile plume infrared signatures calculated based on laboratory data. The plan is to transition this program to the Air Force in FY 1982. Cloud-free line-of-sight impact on potential space laser and infrared surveillance systems will be quantified and the information incorporated into the design methodology of electro-optical space systems. Measurement of the attenuation and/or transmission through cirrus clouds and signal modulation due to cirrus clouds will be completed. Evaluation of the impact of meteorology and climatology on infrared surveillance and laser systems will be completed.

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Detection from Space: The FY 1982 and FY 1983 fiscal years represent major milestones for validating the technical feasibility of a space-based phased array radar. Components for all subsystem developments are being completed and assessed including a small scale membrane antenna with active phase shifters to evaluate RF performance and techniques for adaptive electronic antenna control. A complete silicon transceiver module will be demonstrated at

Plans for prototype production to demonstrate producibility, reliability and survivability in adverse environments will be developed in FY 1982 with planned Air Force funding starting in FY 1983. All components for a gallium arsenide module will be demonstrated and integration into a monolithic assembly will be started for completion and evaluation by the end of FY 1983.

Additional funds have been added to the FY 1983 and FY 1984 budget to continue dual contractor development of the modules and to assure transfer of technology to the prototype manufacturing phase. A system design effort to evaluate the possibilities of a low cost integrated technology demonstration is also funded through FY 1984. An additional increase in FY 1982 and FY 1983 estimated funding is due to initiation of the HI-CAMP II sensor development.

3. Program to Completion: The HI-CAMP sensor and AFGL NKC-135 aircraft will be an integral part of the TEAL RUBY Space Experiment, performing simultaneous spectroradiometric measurements from to assist in analyzing TEAL RUBY measurements from space. The infrared phenomenology program is anticipated to continue through FY 1985 generating infrared signature data on aircraft, missiles and

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summary</u>
<u>IR Early Warning:</u>			
Late FY 1981	Deleted	Measure collisional excitation cross-section of	Transferred to Air Force. Air Force will complete this work, milestone deleted.

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Title: Warning Technology
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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summary</u>
Late FY 1981	Deleted	Complete Cloud Free Line-of-Sight statistical analysis.	Funding not available, milestone deleted.
Early FY 1983	Deleted	Complete IR Airborne measurements of aircraft in backgrounds, cruise missile	Decision to upgrade with HI-CAMP II resulted in program restructuring.
Early FY 1983	Late FY 1982	Complete analyses of air vehicle target measurements.	HI-CAMP I Measurements terminated early due to initiation of HI-CAMP II upgrade.
Early FY 1983	Deleted	Complete measurements and analyses of	Air Force will complete this work.
--	Late FY 1983	Complete test flights of HI-CAMP II Sensor.	New Milestone
Late FY 1982	Late FY 1984	Complete measurements of cruise missile.	Delayed until HI-CAMP II sensor flights initiated.
Mid FY 1983	Late FY 1984	Complete measurements of	Delayed until HI-CAMP II sensor flights initiated.
--	Early FY 1985	Complete Hi-CAMP II Support of TEAL RUBY.	New Milestone

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summary</u>
<u>Detection from Space:</u>			
Late FY 1981	Early FY 1982	Space-based radar membrane tests tests completed.	Passive phase shift modules.
--	Late FY 1983	Additional space-based radar membrane tests completed.	New milestone for active phase shift modules
Late FY 1981	Late FY 1982	Silicon transceiver module completed.	Change from
Late FY 1981	Late FY 1983	Gallium arsenide transceiver module completed.	Funding parallel development with two contractors at reduced levels.
Late FY 1982	Deleted	Complete fabrication and test of laboratory radar modules.	Separate milestones established for silicon and gallium arsenide modules to reflect relative technological maturity.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Warning Technology*	8,674	8,998	7,600	10,300

*Research and development in support of TEAL RUBY is funded in this program element; the TEAL RUBY Experiment is funded in PE62711E, Project EE-2.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-7
Program Element: #62301E
DoD Mission Area: 530

Title: Special Application Technology
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: This project consists of two major thrusts: 1) Strategic Communications; and 2) Space Signal Processing. Strategic Communications is composed of several elements, the primary one being the Passive Communication Satellite (PACSAT). PACSAT is a passive, survivable, jam-resistant, gravity-gradient stabilized, communication satellite concept for modest data rates such as delivering Emergency Action Messages (EAM) and for surviving in a Post-Attack environment. It consists of a long array of spherical reflectors arranged as a diffraction grating in a low earth orbit. In addition to PACSAT, this project is initiating a program in Monolithic Array technology aimed at frequencies in the _____ region of the spectrum. This will eventually provide low cost satellite terminals in a frequency band most desirable for strategic satellite communications. Development of a programmable Electro-Optical (E-O) "mask" is also being continued. This unique device offers the potential for performing _____ and will have application to radar, E-O and communication systems. Space Signal Processing also consists of several elements, the primary one being the Advanced On-board Signal Processor (AOSP). The AOSP program will develop a multi-application spaceborne signal processor using advanced architecture and high speed/low power micro-electronic technology, capable of supporting all projected military space missions to the year 2000. AOSP has a parallel processing architecture with a single building block called the Array Computing Element (ACE). Each ACE consists of a data processor for network control and a signal processor for task computation. This architecture is optimum for long life at minimum cost. In addition to silicon devices, Gallium Arsenide (GaAs) devices will be developed as a radiation-hard technology for the AOSP. Multi-dimensional processing is another element of this project which addresses the detection and tracking of multiple, low visibility targets in an environment dominated by clutter. The Adaptive Space Array was a part of this program and was brought to a successful conclusion.
- G. RELATED ACTIVITIES: This project is related to programs of the Directorate of Space Systems and Command, Control, and Communications (jointly funded), Rome Air Development Center (jointly funded), the Defense Communications Agency, Minimum Essential Emergency Communications Program (MEECN), and the Naval Electronic Systems Command.
- H. WORK PERFORMED BY: Industry (88%), Government In-house Laboratories (2%), and Federal Contract Research Centers (FCRC) (10%). Contractors include: Raytheon Company, Sudbury, Massachusetts; Culler Harrison Inc., Santa Barbara, California; Hughes Aircraft Company, Culver City, California; Pacific Sierra Company, Santa Monica,

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Title: Special Application Technology
Title: Strategic Technology
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California; Trans-Spectrum Corporation; Manhattan Beach, California; and Grumman Aircraft Company, Beth Page, New York. Government In-house Laboratories are: Rome Air Development Center, Rome, New York; and the Naval Ocean Systems Center, San Diego, California. The RAND Corporation, Santa Monica, California and the Institute for Defense Analyses, Arlington, Virginia, provide supporting analysis to the program.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: In the Passive Communications Satellite (PACSAT) program, a concept was developed capable of meeting survivable strategic communications objectives. The assessed survivability of PACSAT exceeded stated military standards (as set by the Joint Chiefs of Staff) and the ability to deliver the EAM was demonstrated by analysis. Studies to investigate electrical equalization have proved negative and efforts to provide mechanical straightening of the array are proceeding. Discussions have continued with the WWMCCS System Engineering (WSE) office to include PACSAT as an integral part of Minimum Essential Emergency Communications Network (MEECN). The space signal processing work was previously reported under ST-6 as part of the Space-Based Radar program. When it became apparent that other space missions could be served by Advanced On-Board Signal Processor (AOSP), a broad range of applications were studied and factored into the basic architectural design. To date, a complete design specification of the AOSP exists including the operating system with both register and gate level designs. The Nodal operating system has been completed and work is progressing on the Global operating system. A broad range of software support tools exist from mission support simulation down to hardware simulation at the gate level. Two ACE's consisting of the data processing portion have been constructed and are currently operating and exchanging information. The Adaptive Space Array successfully demonstrated the ability to cancel a at completion of the program.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In FY 1982 a design will be initiated for a complete transmit/receive satellite terminal with, the flexibility to support a PACSAT satellite demonstration. Discussions are continuing with WSE to jointly fund a satellite demonstration program. Technical studies continue on means to maintain the array suitably straight. On the AOSP program eight copies of the Array Computing Element (ACE), are being constructed including both the data processor and the signal processor. These Array Computing Elements will be exercised with the software simulator to verify the performance of the operating system. The monolithic array

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-7
Program Element: #62301E
DoD Mission Area: 530

Title: Special Application Technology
Title: Strategic Technology
Budget Activity: 1. Technology Base

technology initiated on the Space-Based Radar program is to be extended to higher frequencies in support of strategic space communications. Development of a three terminal device operating from will be demonstrated. This technology offers a potential for dramatically reducing the costs of satellite terminals. Programmable Electro-Optical (E-O) mask development will continue to create a unique E-O processor capable of one billion multiplications per second. The radiation-hardened Gallium Arsenide (GaAs) Very Large Scale Integration (VLSI) development will transition from the 6.1 Program Element into this program element. It is intended that this effort will be directed at the construction of an Advanced On-Board Signal Processor (AOSP) in GaAs. The initial effort will focus on a 16K Random Access Memory. The decrease in funding stems mainly from the decision not to proceed with a PACSAT Satellite design and a delay in the GaAs digital circuit development.

In FY 1983 the design of the PACSAT demonstration will continue. The satellite/terminal configuration simulation will be completed and used to evaluate the operational configurations generated for the demonstration program. Development of a three terminal monolithic device operating from will be demonstrated and efforts will begin on monolithic circuits. Under the Space Signal Processor, the completed AOSP (consisting of eight Array Computing Elements) will be located at Rome Air Development Center (RADC) and exercised in concert with the existing experimental radar facility.

In FY 1984 a decision on a PACSAT satellite program will be made based on the outcome of the technical studies of the terminal designs and the discussions with WSE. The signal processor technology will be integrated into the DARPA/USAF Joint Technology Program and offered as the baseline onboard signal processor. Efforts will begin on using the AOSP and monolithic array technology to construct a fully conformal antenna array for an advanced Airborne Early Warning System. The increase in funding represents maturity of the AOSP and Monolithic circuit technology as reflected by the plans being formulated for transition to operational systems.

3. Program to Completion: The PACSAT demonstration will be constructed and launched into orbit. The ground terminals previously constructed will demonstrate the delivery of the Emergency Action Message (EAM) under operational conditions. These results will be used to upgrade the simulation for use as a design tool. The AOSP will be tested at RADC in the demonstration radar facility. Once the AOSP design has been verified, construction of an all-GaAs version of AOSP will commence for spaceborne military applications. The monolithic

FY 1983 RDT&E DESCRIPTIVE SUMMARY

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 DoD Mission Area: 530

Title: Special Application Technology
 Title: Strategic Technology
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development program will develop low-cost space/ground terminals for use in satellite communications systems for the 1990's time frame. The AOSP and monolithic array technology will be applied to military communication and Radar Systems across the frequency spectrum. These are continuing programs.

4. Milestones: Milestones appearing in the FY 1982 Descriptive Summary for completion in FY 1981 have been completed except as indicated below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
<u>Passive Communications Satellite</u>			
Mid FY 1981	Mid FY 1982	Initiate design of transmit/receive terminals.	Delayed due to program redirection and funding constraints.
--	Late FY 1982	Complete preliminary design of transmit/receive terminals.	New Milestone
Late FY 1981	Deleted	Develop satellite test plan.	Tech studies indicate satellite test plan premature because of inability to use electrical equalization.
Late FY 1982	Deleted	Initiate design of satellite Experimental Demonstration.	PACSAT satellite experimental demonstration has been deferred due to funding constraints.
<u>Space Signal Processor</u>			

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-7
 Program Element: #62301E
 DoD Mission Area: 530

Title: Special Application Technology
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Late FY 1981	Complete austere breadboard and test with simulation.	--
Mid FY 1983	Mid FY 1983	Complete eight ACE AOSP and test with simulation.	--

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Special Application Technology	2,954	2,966	5,300	7,500

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-8
Program Element: #62301E
DoD Mission Area: 530

Title: Space Object Identification
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The goal of this project is to develop and demonstrate advanced techniques for high payoff capabilities in space object identification. The Compensated Imaging System is designed to obtain near real time resolution of satellites to assist in determining their function and evaluating any posed threat. At the present time, because atmospheric turbulence distorts optical images, only gross features can be observed with ground-based telescopes. The Compensated Imaging System will not only provide useful images of satellites, but will also be a convincing demonstration that optics is a viable technology. This optical technology will permit the development of several radically new strategic defense concepts, including space-based systems. The Compensated Imaging System will be operated on a routine basis with the USAF Strategic Air Command Aerospace Defense Command beginning in FY 1982. This will end a productive, twelve year development effort by DARPA in new technology for Space Object Identification. Historically this effort has produced a sensor and two systems which are now providing images of a quality that was generally believed to be impossible prior to 1975. The Compensated Imaging System, when finished in FY 1982, will provide visual images of a quality that was generally believed to be impossible prior to 1975.
- G. RELATED ACTIVITIES: A USAF Program Management Directive has been generated for planning the transition of compensated imaging technology into Ground Electro-Optical Deep Space Surveillance (GEODSS) sites. Operational procedures and interface relationships have been established between USAF and DARPA for joint operations at the combined ARPA Maui Optical Station (AMOS)/Maui Optical Tracking and Identification Facility (MOTIF).
- H. WORK PERFORMED BY: Ninety-eight percent of the effort is performed by private industry. The primary performers are: AVCO Everett Research Laboratory, Everett, Massachusetts; ITEK Corporation, Lexington, Massachusetts; Riverside Research Institute, New York, New York; Analytic Decisions, Inc., Arlington, Virginia; Optical Science Consultants, Yorba Linda, California; and Scripps Institute of Oceanography, San Diego, California. In addition, two percent of the effort is provided by Government in-house activities at the Rome Air Development Center, Griffiss Air Force Base, New York.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-8
Program Element: #62301E
DoD Mission Area: 530

Title: Space Object Identification
Title: Strategic Technology
Budget Activity: 1. Technology Base

1. FY 1981 and Prior Accomplishments: Advanced radar and optical techniques, including data processing and analysis approaches were developed under this project and either transitioned to the Air Force or made available for future exploitation as technology develops. These include (1) the ARPA Lincoln C-Band Observables Radar (ALCOR) at the Kwajalein Missile Test Range providing resolution images of satellites at in altitude; (2) the long range imaging radar additions to the Lincoln Laboratory, Lexington, Massachusetts, Haystack radar providing ; and (3) the radiometer system for satellite measurements, and the system for installed on the twin 1.2 meter (m) telescopes at the DARPA Maui Optical Station (AMOS), Hawaii. Transition of this portion of the AMOS Facility to USAF Aerospace Defense Command (ADCOM) was completed at the end of FY 1979 and is now operated by ADCOM as the Maui Optical Tracking and Identification Facility (MOTIF). The Compensated Imaging Program was initiated in FY 1975 to achieve , visible wavelength imagery of the optical wavefront distortion induced by atmospheric turbulence, the prime contributor to image degradation. Measurements were made of the size of turbulence cells at AMOS in FY 1976 to determine the needed for the . Testing has verified the design and operation of the system and all critical subsystems. A simulation program was developed for the CI system and has been used constructively as a design and validation tool. A feasibility model was constructed of an optical system and field testing confirmed the analytical models used in design. Construction was completed of a Compensated Imaging (CI) Field unit and the system was successfully operated in closed loop laboratory tests in late FY 1980. The CI field unit was delivered to AMOS in late FY 1981 for installation on the 1.6 meter telescope. The program to generate concepts and develop technology for a system was initiated. A concept formulation study completed in FY 1976 showed that the optics technology developed for the Compensated Imaging System and continued on a larger scale under the High Altitude, Large Optics (HALO) program for spaceborne surveillance sensors was an adequate starting point for the optics require for . Design and critical component development for optical components was conducted in FY 1978 and FY 1979 as were programs in advanced system design definition and utility analysis. The results of the TEAL GARNET program were transitioned to the Navy in 1981.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Compensated Imaging: The Laser Beam Director facility at AMOS is being used for laser ranging and illumination tests by other government agencies. Laser beam

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-8
Program Element: #62301E
DoD Mission Area: 530

Title: Space Object Identification
Title: Strategic Technology
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experiments will be performed in FY 1983 in support of DARPA Directed Energy Office programs. A measurement capability is being added to the 1.6 meter telescope. Acceptance testing and performance evaluation of the Compensated Imaging (CI) field unit on the 1.6 meter telescope at AMOS is being completed. USAF evaluation of the CI field unit on the 1.6 meter telescope will be completed in FY 1983. Data transfer and tasking procedures will be finalized with USAF Aerospace Defense Command (ADCOM). This facility will provide the USAF, for the first time, real-time high quality optical imagery at resolution. Together with the previously installed capability at AMOS/MOTIF, this will provide significantly improved characterization of near earth orbit satellites in fulfillment of the Space Object Identification function of ADCOM.

3. Program to Completion: The Compensated Imaging System, Laser Beam Director, and capabilities at AMOS will be maintained in cooperation with USAF as a national facility for experiments in (for example) space surveillance, laser beam measurements. Funding for FY 1983 and beyond will be applied for this purpose and to secure continuous upgrades in the facilities.

4. Milestones:

<u>Last Year's Report Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Uncertain	Complete acceptance testing of Compensated Imaging Charge Coupled Device (CCD) camera.	Low process yield for CCD Chips. Other chips and cameras under evaluation.
Mid FY 1981	Early FY 1982	Complete integration of CI Field unit with AMOS telescope.	Delays in subsystem and system level testing.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-8
 Program Element: #62301E
 DoD Mission Area: 530

Title: Space Object Identification
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

<u>Last Year's Report Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Mid FY 1982	Complete feasibility demonstration of CI field unit.	Accomodate slip in integration with AMOS telescope.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Space Object Identification	4,453	4,400	2,800	3,500

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-9
Program Element: #62301E
DoD Mission Area: 530

Title: Submarine Laser Communications
Title: Strategic Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The DARPA/Navy Submarine Laser Communication (SLC) Program is developing the technology necessary for providing critical subsurface communications, using blue-green lasers. The specific payoffs of this system would be: (1) providing critical messages to SSBN's in pre-, trans- and post-SIOP at depth without compromising the submarine's natural covertness, thus helping to ensure the SSBN force's continued high level of survivability to even the most severe hypothetical threats of the future; (2) increased robustness and survivability of the C³ system well into the post-attack period; (3) allowing the SSN to work most effectively in its own environment while providing it threat and target intelligence information without requiring it to break off its operations to receive data on or near the surface; (4) controlling a broad variety of pre-placed underwater assets, such as minefields and acoustic arrays.

The specific objectives of the DARPA/Navy SLC program are: (1) Preserve the option for a decision for deployment of a (mirror satellite, laser satellite or mix) SLC Satellite system which demonstrates an enhancement of the fighting effectiveness of our submarine forces; (2) Exploit tactical airborne SLC as rapidly as is feasible; (3) Achieve an effective transition to the Navy for both SLC Airborne (SLCAIR) and SLC Satellite (SLCSAT) programs.

SLC System Concepts. In the near term blue-green laser communications could be used in direct support operations. In this case the laser would be installed in a variety of aircraft, both carrier and land based. Threat and target data, as well as control orders, would be radioed from the battlegroup to the aircraft and converted into laser pulses. There would be no attempt or need to localize the submarine. In the event that report back was desired, the submarine could use a buoy or come to periscope depth to establish radio communications.

Equipment available in should be able to provide communications over all of a operating area to depths of feet, or more, of the time. At reduced data rates, even greater depths can be reached. When the cloud cover is extremely heavy or in the dirtiest water, data rates or depths would be reduced.

In order to , use of satellites is mandatory. There are two basic satellite approaches being pursued, but the technology state is not yet advanced sufficiently to make a decision between the two based on cost, risk, and utility.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-9
Program Element: #62301E
DoD Mission Area: 530

Title: Submarine Laser Communications
Title: Strategic Technology
Budget Activity: 1. Technology Base

Whichever approach is used, mirror satellite (MS) or laser satellite (LS), the downlink beam travels from the satellite through clouds to a diameter spot on the water. Data rates transmitted to submarines in this spot can be high, perhaps . The message is transmitted to the spot, then the beam is stepped to a new spot, and the message is retransmitted. The process continues until the entire operating area is covered, and this reduces the average data rate accordingly. The wide coverage area eliminates any possibility of the enemy localizing the submarine.

Another feature of SLC is that it is a spotcast as opposed to broadcast system. This means that different messages can be sent to different areas with no time penalty, and results in a improvement in message delivery time over broadcast systems in some circumstances.

- G. RELATED ACTIVITIES: There are several supporting Navy programs in areas such as blue-green laser technology and optical oceanography. Other major technology areas, such as space optical systems and atmospheric compensation, are coordinated with ongoing Air Force, Navy, and DARPA programs through a variety of formal and informal mechanisms including joint use of facilities, personnel, and contracting agents.
- H. WORK PERFORMED BY: Industry (85%), university (5%), and government in-house laboratories (10%). Contractors include: TRW, Los Angeles, CA; Hughes Aircraft Company, Los Angeles, CA; McDonnell Douglas Astronautics Company, St. Louis, MO; GTE Sylvania, Mountain View, CA; Lockheed Missiles and Space Company, Palo Alto, CA; Pacific Sierra Research Corporation, Santa Monica, CA; AVCO, Boston, MA; Mathematical Sciences Northwest, Bellevue, WA; Itek Corporation, Lexington, MA; Northrop Corporation, Palos Verdes Peninsula, CA; Rockwell International, Canoga Park and Thousand Oaks, CA; Adaptive Optics Associates, Cambridge, MA; Eastman Kodak, Rochester, NY; and Lincoln Laboratory, Lexington, MA. The university work is being done by the University of California's Scripps Institute of Oceanography and the University of Arizona's Optical Science Center. In-house effort is being funded at the Naval Ocean Systems Center, San Diego, CA; Naval Research Laboratory, Washington, D. C.; and Rome Air Development Center, Rome, New York.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-9
Program Element: #62301E
DoD Mission Area: 530

Title: Submarine Laser Communications
Title: Strategic Technology
Budget Activity: 1. Technology Base

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The first aircraft-to-submarine laser communication tests using the SLC concept were conducted in waters off San Diego in May 1981. This experiment, SLCAIR-81, conclusively demonstrated the feasibility of communications with pulsed blue-green lasers through clouds and water under a variety of conditions. The one-watt laser, flown on an aircraft at feet altitude, and the 3 inch, 2 Angstrom bandpass MK I SLC receiver, installed in USS Dolphin, a Navy research submarine, are very limited and crude equipment, but they still allowed communications to over . Clouds ranged from 800 to 1,600 feet in thickness, the water (dirtier than previously expected) was typical of that found in actual operating areas, and intense bioluminescence was observed in the area. Actual performance matched predictions very closely, and simple scaling shows planned technology levels for FY 1984/1985 should support poor weather, full daylight communications to feet and feet or more at night. Additional tests results contributing to confidence in the Navy SLC performance prediction model have been a 1979 heavy cloud propagation experiment, the continuing construction of world-wide properties data base from satellite observations, and extensive bioluminescence data taken from a Navy submarine in active waters.

Major milestones have recently been met in all critical technology areas required for airborne or space SLC capabilities. In the Phase I space laser development competition, mercury bromide devices far exceeded the technology goals of a 1 joule pulse at 1% total efficiency, and will be continued to address the more difficult lifetime and efficiency issues. For the mirror satellite approach, in 1981 a xenon fluoride laser surpassed its single pulse goal of , approximately

. Another xenon fluoride laser has successfully demonstrated repetitive pulse operation. Atmospheric compensation was demonstrated in the laboratory in mid-1981, serving as the basis for future field experiments through the real atmosphere. Not only did the Mark I SLC receiver used in SLCAIR-81 demonstrate 2 Angstrom bandpass, 3 inch aperture, and a ± 15 degree field of view in water (approximately 1,000-fold throughput improvement over past technology), but a Cadmium Sulfide module has also been demonstrated, promising an additional improvement. Either the quartz or the CdS filters are adequate to support actual operational receivers.

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DoD Mission Area: 530

Title: Submarine Laser Communications
Title: Strategic Technology
Budget Activity: 1. Technology Base

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In support of SLC program objectives and the major decision points of 1984/1985 (described in the following section), technology development, experiments, and designs for major tests will be conducted in three areas: tactical airborne SLC and both laser satellite and mirror satellite approaches. For the laser SLCSAT, the principal risk area is the laser itself, and a major effort will identify the spacecraft engineering issues associated with each of the candidate space laser technologies in order to allow us to concentrate resources on the most promising from the viewpoint of the final application, not just near term experiments. The current leading candidate, Mercury Bromide (HgBr), will be taken to a 200 watt laboratory breadboard by the end of FY 1984, and other candidates (Raman shifted XeCl, copper vapor, and frequency doubled, diode pumped Neodymium glass, etc.) will be thoroughly evaluated in laboratory tests. A conceptual design for a first end-to-end laser satellite experiment will be completed by FY 1984 for the most promising candidates.

For the mirror satellite approach the greatest risk in a first SLCSAT experiment is the integration of the many complex technologies required for successful operation. Therefore this effort focuses on a preliminary design effort and concomitant technology demonstration in many areas: adaptive optics, pointing and tracking, mirror panel fabrication and control, coatings and so on. Major experiments will be performed in two areas: first, the Lincoln Laboratory atmospheric compensation experiment will be installed in a beam director at the DARPA optical station on Maui (AMOS) for low power compensation tests on a horizontal path (1982), to an aircraft (1983), and finally to a sounding rocket at 400-600 kilometer altitudes (1984). Second, within the DARPA high energy visible laser program, a high power, closed cycle XeF experimental laser will be designed and built in stages over the next few years. SLC funds will support features to test conversion to blue-green light for the mirror satellite approach.

In order to move from the aircraft-to-submarine feasibility test of SLCAIR-81 to similar experiments in stressing environments in the SLC Program will complete two Mark 2 SLC receivers, one based on quartz and the other on Cadmium Sulfide (CdS) filters. These receivers will not only be used on USS Dolphin, but will be directly compatible with simple installation on many operational attack submarines for testing. To support these tests, an airborne laser of approximately will be built using near-term technology.

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Project: #ST-9
 Program Element: #62301E
 DoD Mission Area: 530

Title: Submarine Laser Communications
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

Advanced technologies will be pursued where they offer the hope of radical performance, reliability, or cost improvements in the baseline system. Two areas singled out for intense advanced technology work are receivers, where greatly improved ease of manufacture and material availability is the goal, and the space laser, with goals of efficiency and a degree of simplicity compatible with long life in space.

3. Program to Completion: The overall program strategy is to achieve early (1984/1985) operational level tests of technology supporting airborne tactical SLC and to transition that part to the Navy for engineering development and exploitation. In the far term, the objective is to be in a position to support an informed deployment decision for a SLC satellite system. The SLCAIR portion is defined by SLCAIR-84/5 experiments and deployment decision will be based on technology development and demonstration, subsystem-level experiments, Navy operational utility and survivability assessments, and a potential first end-to-end SLC satellite experiment (SLCSAT-1). In the near term, the technology efforts are geared toward supporting a FY 1984 decision on what, if any, SLCSAT-1 test is to be flown. SLCSAT-1, if launched, will have a residual operational utility as well as resolve remaining experimental issues and will be based on completely scalable technology.

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Early FY 1982	Late FY 1982	pulse from blue-green ground-based laser.	Priority Revision to match overall program pace.
Late FY 1982	Mid FY 1983	aperture, submarine compa- tible receiver complete.	Priority revision to match overall program pace.
Mid FY 1983	Mid FY 1983	Mirror satellite preliminary design.	No change.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #ST-9
 Program Element: #62301E
 DoD Mission Area: 530

Title: Submarine Laser Communications
 Title: Strategic Technology
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1983	Late FY 1983	Laser beam compensated for turbulence through full atmosphere to aircraft.	No change.
Late FY 1983	Mid FY 1984	Severe conditions aircraft to sub communications experiment.	Adjusted to match availability of higher power laser - not a part of original plan.
--	Late FY 1984	Laser beam compensated for turbulence through full atmosphere to sounding rocket.	New Milestone.
--	Late FY 1984	Hardware decision point for first end-to-end Submarine Laser Communication Satellite Experiment (SLCSAT-1).	New Milestone.
--	Mid FY 1985	Tactical Airborne SLC test.	New Milestone.

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Submarine Laser Communications	\$27,341	\$28,200	\$31,200	*
* Funded in PE62711E, Project EE-16				

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62702E
DoD Mission Area: 530

Title: Tactical Technology
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
TOTAL FOR PROGRAM ELEMENT		\$84,348	\$84,715	\$103,900	\$139,700	Continuing	N/A
TT-1	Target Acquisition and Engagement	20,071	25,211	32,950	45,100	Continuing	N/A
TT-2	Weapons Technology and Concepts	26,429	31,617	31,175	41,100	Continuing	N/A
TT-3	Naval Warfare	35,903	20,887	32,875	45,600	Continuing	N/A
TT-4	Advanced Armor Technology	1,945	5,000	6,900	7,900	Continuing	N/A

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is dedicated to the development of advanced technologies and concepts that will serve as the basis for development of the next generation, tactical systems. The overall program goal is to substantively advance non-nuclear, tactical, combat capabilities with careful consideration to both realistic cost and Service manpower constraints. The program technology development objectives are grouped into four major categories: (1) improving target acquisition and engagement capabilities; (2) advancing fire control, seeker, command and control and weapon technology; (3) improving tactical naval warfare capabilities; and (4) improving armor technology, all to counter the expanding tactical threats.

C. BASIS FOR FY 1983 RDT&E REQUEST: Overall project objectives are to develop advanced technology for the following applications: (1) detection, acquisition and engagement of enemy ground and airborne targets with bistatic radar sensors and weapons that, if successfully developed, will form the basis for a new generation of

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62702E
DoD Mission Area: 530

Title: Tactical Technology
Budget Activity: 1. Technology Base

survivable battlefield systems with expanded performance capabilities; (2) the development of surveillance and targeting concepts against next generation, low radar cross section, stealth vehicles; and (3) advanced imaging infrared and millimeter wave radar seekers which may be applied to both gun-fired projectiles and missiles. Major emphasis has been placed on developing the technology for (4) an advanced fire and forget anti-armor seeker capable of achieving a high hit probability against advanced armored combat vehicles, (5) initiation of a concept to target critical battlefield control nodes, (6) new indirect fire cannon concepts, (7) an all digital radar capable of multi mode, adaptive operation in an ECM environment, and (8) use of electro-magnetic propulsion for gun applications. Other objectives include (9) the development of processing algorithms to perform acoustic ocean search, target localization, tracking and classification using the current

effort is under way to develop means to integrate and correlate the outputs of a spectrum of wide area surveillance sensors to provide Over-the-Horizon (OTH) targeting information to commanders at sea. Similarly, (11) work is also underway on the development of array with a satellite data read-out and (12)

Beyond passive submarine detection, (13) the use of high level acoustic sources is under study for active ranging

. In the tactical ASW area, efforts proceed on (14) the use of off-board sensors and an interconnecting data link to improve the acquisition performance of future torpedoes and the development (15) of a new class of advanced submarine conformal sonar arrays embodying a newly developed technology base in hydrophones, platform noise reduction, and array beamforming. The objective of the armor technology effort (16) is to explore and demonstrate the technical feasibility of advanced armor systems to provide ballistic protection against large and small caliber munitions.

- D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The increase in Target Acquisition and Engagement (TA&E) Project in FY 1982, reflects the initiation of the counter stealth program, the critical node targeting program and the all-digital radar program. Changes in major program milestones include a 12 month slip in the counter stealth program, due to FY 1981 funding cuts.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62702E
DoD Mission Area: 530

Title: Tactical Technology
Budget Activity: 1. Technology Base

The decrease in the Weapons Technology and Concepts program area in comparison to that presented in the FY 1982 Descriptive Summary is primarily due to reductions to the Sanctuary Radar project, electromagnetic force (EMF) gun program, tactical nuclear targeting project which was partially offset by the addition of the Advanced Indirect Fire System (AIFS) program which had been transferred from E #62711E project EE-13.

The FY 1982 projected budget for the Naval Warfare (formerly Ocean Monitoring and Control) project reflects a reduction of \$7.1 million from the amount cited in the FY 1982 RDT&E Descriptive Summary. Reductions were related to the transition of the Acoustic Research Center to Navy control and the progress of other former SEAGUARD projects to Service transition. These were accompanied by a substantial increase in scope for the Ocean Tactical Targeting and Advanced Conformal Submarine Array System, but the net result has been the decrease reported. All other programs continue essentially as planned. In the FY 1982 summary, the Advanced Armor effort was included in the Weapons Technology and Concepts Project.

E. OTHER APPROPRIATION FUNDS: None

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #TT-1
Program Element: #62702E
DoD Mission Area: 530

Title: Target Acquisition and Engagement
Title: Tactical Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The major goal of this project is to significantly increase the U.S. force's capability to acquire and engage tactical targets. A significant problem on the battlefield of the future is to locate, identify, and attack the enemy in both first and second echelon formations in weather, at night, and while encountering defensive weapons, electronic countermeasures, and deception tactics. This project includes sensor and weapons programs, each of which is designed to meet a current mission shortfall with advanced technology. To meet this project goal, five ongoing elements are included: (1) bistatic radar techniques to increase radar survivability by placing the vulnerable transmitter in a Sanctuary or by using existing "sanctuary" transmitters, such as AWACS, operating with separate receivers; (2) a closed loop, deception electronic countermeasures (DECM) concept, called Surgical Countermeasures, to operate against advanced radars and missile seekers; (3) advanced detection and engagement concepts for defense against next generation cruise missiles called Cruise Missile Defense; and (4) integrated active and passive location techniques called Critical Node Targeting, for engaging second echelon force elements. A fifth element added in FY 1983 is the All Digital Radar, which will use a digital signal processor to form the antenna beams as well as process their output signals, providing enhanced detection and tracking capabilities at significantly lower cost than conventional radars using conventional phase shifters.
- G. RELATED ACTIVITIES: Project interaction with the Services include early information exchanges, with transition to joint developments when common program objectives and technology issues are identified. The Sanctuary Bistatic Radar program is jointly funded by the Air Force and by the U.S. Army, both under Memoranda of Agreement. An element of the Sanctuary Bistatic Radar program, called Tactical Bistatic Radar Development (TBIRD) forms the basis for the USAF's Covert Strike program, PE #63103F. The Surgical Countermeasures program is jointly funded with the Navy, under a Memorandum of Agreement, and exploits technology developed earlier by the Navy, under Program Element 62712N. Investigations of the Assault Breaker concept, the Forward Swept Wing technology, and the Battlefield Exploitation and Target Acquisition (BETA) testbed, coupled with the Coherent Emitter Location System (CELT), all of which had been included in this program element in FY 1980 and prior years, were transferred to PE 62711E in FY 1979, FY 1980 and FY 1981, respectively. Work on the Fire and Forget seeker, including the Advanced Forward Looking Infrared (FLIR) system and the STARTLE millimeter wave sensor, which had been included in this program element in FY 1980 and prior years, was transferred to PE #62702E, Project #TT-2 in FY 1981. Both the Cruise Missile Defense and Critical Node Targeting programs are being developed with the U.S. Air Force Rome Air

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Development Center; joint funding and Memoranda of Agreement are anticipated. The Cruise Missile Defense program applies the technology developed under the Netted Radar and Hybrid Signal Processing efforts, both included in this program element during FY 1981 and prior years. The new element, All Digital Radar, is being developed with the U.S. Army Missile Command; joint funding and a Memorandum of Agreement are anticipated.

H. WORK PERFORMED BY: All the efforts are funded with industry, which include: MIT/Lincoln Laboratory, Lexington, Massachusetts; International Business Machines, Gaithersburg, Maryland and Owego, New York; Technology Service Corp., Santa Monica, California; Hughes Aircraft Company, El Segundo, California; General Electric, Utica, New York; TRW, Redondo Beach, California; Norden Systems, Norwalk, Connecticut; Raytheon Corporation, Lexington, Massachusetts; Advanced Information and Decision Systems, Inc., Mountain View, California; and E-Systems, Garland, Texas.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The Sanctuary bistatic radar program (with the transmitter remoted from the threat area) completed short range, feasibility tests and clutter measurements in FY 1977. As a result, the development of a long range air defense testbed (ground-based receiver) and an air-to-ground attack testbed (airborne receiver) were initiated in FY 1978. Air defense testbed experiments were completed in FY 1980, and demonstrated for the first time that tactical air targets could be detected at long range and in ground and sea clutter. This success gave rise to the Bistatic Alerting and cueing element of the Sanctuary program which, in FY 1981, initiated design activity for a small, low cost, bistatic battlefield threat warning and cueing receiver for the U.S. Army. The air-to-ground attack testbed (TBIRD) was constructed to demonstrate both vulnerability reduction and performance enhancement -- through forward-looking Synthetic Aperture Radar (SAR) mapping directly on the aircraft's velocity vector, something that cannot be done with a monostatic radar. Development of the testbed continued through FY 1980 and initial tests were conducted in FY 1981; they were not successful, primarily due to instrumentation difficulties. A second set of field tests are planned in late FY 1982 and early FY 1983. Analysis of target glint reduction for semiactive (i.e., bistatic) homing missiles was completed in FY 1979, and validated at Pacific Missile Test Center, Pt. Mugu, California. In the Surgical Countermeasures program laboratory tests against an advanced

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radar successfully demonstrated the concept of closed loop deception, where victim radar antenna response was monitored remotely, and fed back to control the deception signal. In FY 1981, development of a field test demonstration system was started, in anticipation of field tests against Soviet radar emulators in FY 1982 and FY 1983. The Cruise Missile Defense program was begun in FY 1980 with a short series of tests and measurements of forward scatter radar cross section parameters using test facilities available at the Pacific Missile Test Center, Point Mugu, California. Work on CMD was interrupted in FY 1981 due to budget cut but will continue at an increased level during FY 1982. For Critical Node Targeting, a bi-service multi-agency workshop was held to consider vulnerabilities of the Soviet command and control structure and means of exploiting these vulnerabilities to interdict second-echelon forces. The workshop's results led to formulation of the Critical Node Targeting program which began in-house concept analysis in FY 1981. A preliminary design effort to reduce development risk was completed on an advanced receiver concept called METASCAN as part of Critical Node Targeting. This new receiver concept will analyze multiple signals for the determination of force size and location. Work on the new element, All Digital Radar, was begun by defining a system concept and constructing a preliminary breadboard at the U.S. Army Missile Command's laboratory.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The major FY 1982 and out year program objectives consist of design, evaluation, development, fabrication, field testing, and transition of technology and associated system concepts.

In FY 1982, the Sanctuary bistatic radar program's long range air defense testbed transitions to the new Cruise Missile Defense program for forward-scatter radar cross section enhancement measurements. The air-to-ground testbed (TBIRD) initiates the second set of field tests, demonstrating silent attack, forward-looking synthetic aperture radar (SAR) mapping, and ECCM performance. The testbed includes real time operation and hybrid monostatic/bistatic operation. Fabrication of the Bistatic Alerting and Cueing (BAC) testbed is started. In the Surgical Countermeasures program the breadboard testbed development is complete and field tests are started at NWC, China Lake, California. Technology related to the Advanced Surveillance Radar and to Hybrid Signal Processing, reported in the FY 1982 RDT&E Descriptive Summary, is transferred to the Cruise Missile Defense program. The Cruise Missile Defense program analyzes new sensor and signal processing concepts for detecting, tracking and engaging air vehicles, flying at low altitudes,

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Concepts include low frequency airborne radars (Teal Rain Radar), forward scatter and multistatic radars, specialized signal processing, and low cost, proliferated sensors. The Critical Node Targeting program conducts a comprehensive system analysis to identify the critical parameters required to locate and target enemy force elements,

critical experiment is planned during FY 1983 using existing sensors to assess the feasibility of the concept and to refine systems requirements. Engineering definition of the radar and electronic support measures systems are derived from the systems study. The METASCAN receiver is designed, breadboarded and initial fabrication has begun. A detail test plan is developed to assess the full potential of the receiver's concept. The All Digital Radar program begins concept and design formulation to identify critical areas of design and to develop a testbed for the medium-range tactical air defense mission.

For the FY 1983 Sanctuary bistatic radar program, the air-to-ground attack testbed (TBIRD) will have completed its field demonstration, and be transitioned to the Air Force as part of their Covert Strike Program. The Bistatic Alerting and Cueing (BAC) concept will commence joint field tests with the U.S. Army, using the All Weather Airborne Control System (AWACS) and simulated Stand-Off Target Acquisition System (SOTAS) radars as the standoff illuminators. In the Surgical Countermeasures program, field tests against advanced radar/seekers will have been completed, and the program transitioned to the U.S. Navy. In the Cruise Missile Defense program design, simulation and evaluation of low frequency airborne radar techniques and the forward scatter/multistatic radar concepts will have been completed, and integration efforts for field test demonstration of the most promising techniques will begin. In the Critical Node Targeting program the system analysis has been completed, with the delivery of a detailed system definition, operational performance estimates and technology issues. The critical technology issues are identified and a system demonstration will commence with the initiation of the design and fabrication of the critical sensor components, both active and passive. The METASCAN advanced development receiver will undergo an extensive test program to determine its fidelity across the intercept bandwidth. Detailed application assessments will be undertaken to determine the proper demonstration project for this versatile receiver concept. The All Digital Radar designs will be complete and construction of a concept-feasibility model begun.

For FY 1984, the Bistatic Alerting and Cueing (BAC) program will have completed a joint field demonstration and, if successful, will transition, to the U.S. Army for advanced development, possibly in the Short Range Air

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Defense Systems-Command and Control (SHORADS-C2) testbed. In the Cruise Missile Defense program, operational requirements and technical interfaces will have been identified, followed by design initiation of testbeds for the selected approaches. The testbed development and integration of at least two competing approaches is anticipated. In the Critical Node Targeting program, the active and passive sensor will be fabricated and will begin final integration into the demonstration platform. Three additional METASCAN receivers will be developed for testing in an emitter location system. The systems will be transferred to the Critical Node Targeting effort. The All Digital Radar testbed will be completed and joint testing with the U.S. Army begun.

3. Program to Completion: This is a continuing program. New initiatives will be evaluated as technology options permit. The bistatic hybrid radar technology will have been transferred for both retrofit and new radar development by the Services, starting in FY 1984. Field demonstrations of the new Cruise Missile Defense technologies will be conducted starting in FY 1984, and continuing through FY 1985; Service transition is anticipated in late FY 1985. Field demonstration of the Critical Node Targeting testbed will commence in the United States in FY 1985, continuing into FY 1986 with a European demonstration; Service transition is anticipated in FY 1986. The All Digital Radar will be proven in a field demonstration and transferred to the U.S. Army for further development in medium-range air defense.

4. Milestones: Milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Early FY 1982	Mid FY 1982	Surgical Countermeasures Field Test.	Delay in contracting work with industry.
Mid FY 1981	Mid FY 1982	Sanctuary Radar Air-To-Ground (TBIRD) tests.	Retest scheduled in FY 1982 to verify and extend data taken in FY 1981.

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Late FY 1982	Hybrid Monostatic/Bistatic/LPI Radar Integration.	No change.
Late FY 1982	Early FY 1983	Field Tests for Bistatic Alerting and Cueing.	Slipped due to delays in source selection contract award.
---	Mid FY 1983	Transition of TBIRD to the USAF.	New milestone.
Mid FY 1983	Mid FY 1984	Development of a Critical Node Targeting (CNT) testbed.	Effort delayed one year because the program was not funded in FY 1981.
Late FY 1983	Late FY 1984	Selection of Cruise Missile Defense Concepts for Field Tests.	Delayed because the program was not funded in FY 1981.
---	Mid FY 1984	Metascan Receiver transitioned to CNT Program.	New milestone.
---	Mid FY 1985	Demonstration of CNT testbed	New milestone.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Target Acquisition & Engagement	20,071	25,211	32,950	45,100

Programs in this project are jointly funded by the Army, Navy and Air Force.

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Project: #TT-2
Program Element: #62702E
DoD Mission Area: 530

Title: Weapons Technology and Concepts
Title: Tactical Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The overall objective of Weapons Technology and Concepts is to offset the greater number of enemy weapon systems on the modern battlefield with the increased effectiveness of our weapon systems. This project includes the development of advanced seeker technologies for precision guided munitions and the application of those technologies in both direct and indirect fire weapon systems; the development of new propulsion technologies for direct and indirect fire weapon systems; and investigation of new concepts for enhancing battlefield command and control. The Assault Breaker program, originally a part of Project #TT-2, is now described under PE #62711E: Experimental Evaluation of Major Innovative Technologies (EEMIT). The Advanced Seeker Technology program (formerly Tank Breaker and Advanced Indirect Fire System - AIFS) will develop seeker technology for the use of terminally guided munitions to attack and defeat advanced armored combat vehicles in both open and urban terrain. The Advanced Seeker Technology program includes the development of advanced imaging infrared and wave millimeter seekers, automatic target tracking, low cost guidance and control, and missile trajectory control to achieve top attack against armored targets. The Electro-Magnetic Gun (EMG) program explores the utilization of alternative electromagnetic propulsion techniques for gun and launcher applications. The primary purpose of this program is to demonstrate the feasibility of this technology for military application by developing an EMG laboratory launcher system and ultimately technology demonstration systems for air defense, armor, or artillery applications. The EMG hypervelocity laboratory launcher will provide a unique capability for basic and applied research in electromagnetic propulsion and terminal ballistics by providing a capability to accelerate projectiles to very high velocities. The Advanced Seeker Signal Processing (ASSP) program is a new activity and takes the place of effort on the Guided Anti-Armor Motar Projectile (GAMP) contained in last year's submission. Precision terminal guidance for the broad class of ground targets has been under investigation by DARPA and the Services for the past five years. Existing programs for the development of Terminally Guided Submunitions (TGSM) are based upon low resolution infrared seeker technology that is currently available. TGSM target acquisition algorithms for target detection and acquisition have been based upon gross amplitude and size information. As more advanced high resolution imaging infrared focal plane array sensors become available, a more advanced set of target acquisition algorithms must be developed and tested. This effort will do that. Development of improved terminal guidance signal processing techniques will enhance the operational capability of terminally guided munitions using advanced sensors. Success in establishing such a capability would substantially reduce the numbers of munitions required, reduce collateral damage, permit use of smaller warheads, and reduce launcher and countermeasure vulnerability. The Advanced Command and Control Systems Technology is a new initiative, with the

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following rationale. The capability for survivable, reliable, real-time command and control (C²) for management of the battle is one of the most critical requirements for the Services today. A major problem in current C² systems is that individual data processing systems have been developed that cannot collectively share data. Further, both data processing and communication systems have been developed from the perspective of data processors and communicators rather than the user commander and his staff. Both DARPA and the Army are investigating means of providing integrated communications and processors to support the near real-time information flow required among processors, sensors, and commanders. These efforts are coordinated closely and approached not only from the perspective of data processing and communications technology, but also from the systems perspective of analysis and integration of user requirements, starting at the small unit levels and progressing up to the Division level. This requires the development of new technological concepts, advanced processing, data exchange, and display. Advanced techniques of communication technology will be considered and evaluated.

- G. RELATED ACTIVITIES: The Advanced Seeker Technology program is applicable to Army and Marine Corps man portable anti-tank systems, as well as air-to-surface anti-tank weapons, and anti-air weapons. The Electro-Magnetic Gun (EMG) program is a joint effort with the Army Armaments Research and Development Command (ARRADCOM) and has maintained close ties with related work pursued by both the United States Air Force and the Government of Australia. Further, the Navy's on-going program in pulsed power sources (funded through both the Office of Naval Research and the Naval Air Systems Command) can be expected to contribute in the area of energy supplies and storage devices for electromagnetic gun-type weapons. The entire Department of Defense (DoD) effort is coordinated by the so-called "DoD Working Group", which includes representatives of the Services, the national laboratories, and DARPA. DARPA will demonstrate the feasibility of EMG technology for military development, ARRADCOM will have primary Service responsibility for implementing the technology in advanced development programs. The Advanced Seeker Signal Processor program enhances technology developed under Assault Breaker and the Advanced Seeker Technology program.
- H. WORK PERFORMED BY: About 85% of the work is performed by industry, 5% by universities, and 10% by DoD in-house laboratories. The principal contractors are: Hughes Aircraft Corporation, Canoga Park, California; Martin Marietta Corporation, Orlando, Florida; Norden Systems, Incorporated, Norwalk, Connecticut; AVCO, International, Wilmington, Massachusetts; Texas Instruments, Dallas, Texas; and Northrop Corporation, Palos Verdes, California.

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Universities include: University of California - Los Alamos Scientific Laboratories, Los Alamos, New Mexico; Lawrence Livermore Laboratories, Livermore, California; Massachusetts Institute of Technology, Cambridge, Massachusetts; University of Texas, Austin, Texas; and U.S. Naval Postgraduate School, Monterey, California. Government laboratories are: U.S. Army Armaments Research and Development Command, Dover, New Jersey; U.S. Army Missile Command, Huntsville, Alabama; U.S. Air Force Armament Development Test Center, Eglin Air Force Base, Florida; and White Sands Missile Range, New Mexico.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Advanced Indirect Fire System (AIFS): This program was initiated in early FY 1979 in cooperation with the U.S. Army to develop an advanced technology, autonomous weapon system with self-contained target acquisition. DARPA concentrated on the development of terminal homing, lock-on-after-launch seeker technology for a cannon artillery projectile. Phase I definition studies for competing projectile/seeker concepts were completed in October 1980. Two prime contractors were selected for Phase II of this program, critical component development. Critical technologies were investigated for advanced infrared and millimeter wave radar seekers, for ramjet propulsion and flight control for an extended range eight inch projectile, and for system designs for both eight inch and 155 mm projectiles.

Electro-Magnetic Gun (EMG): By FY 1980, engineering designs were completed and fabrication initiated for a large hypersonic laboratory rail gun intended to accelerate a projectile to a velocity of

This device will be installed in mid FY 1982 at the Army Armaments Research and Development Command (ARRADCOM), Dover, New Jersey, where it will be used in a coordinated program for advancing the technology base in rail gun components, power supplies, projectiles, and hypervelocity terminal ballistics. Simultaneously during FY 1980 and 1981, several alternative electromagnetic launcher configurations were examined, including explosively driven rail guns, plasma pinch accelerators, and helical rail guns capable of launching small gliders at high payload efficiencies. In the power supply area, prior to FY 1981, substantial progress was achieved in reducing the size and weight of homopolar generator systems capable of supplying the energy required (tens of Megajoules) for weapon scale launchers, and several prototypes were built. In late FY 1981, operational analyses were completed for gun systems incorporating emerging electromagnetic propulsion technologies and indicated that the

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significant increases in projectile speeds available here can produce major increases in effectiveness in applications where reduced time-of-flight and/or increased projectile kinetic energy are important factors.

Advanced Seeker Technology: This program, formerly called Tank Breaker and the Advanced Indirect Fire System, was initiated in April 1980 after concept definition studies and the results of the Fire and Forget Seeker program indicated the potential for an advanced manportable anti-armor/assault weapon system to integrate emerging technologies for high density imaging infrared focal plane arrays, advanced signal processing, missile guidance and control, reduced impulse launch mechanisms, progressive burning rocket motors, and advanced warheads in a low cost, high performance, day/night, fire and forget missile. Four contractors demonstrated competing concepts for imaging infrared focal plane array seekers, missile launch, and guidance and control throughout FY 1981, culminating in captive flight tests in first quarter 1981.

Advanced Seeker Signal Processing (ASSP): ASSP is a FY 1981 initiative. Algorithms for signal enhancement and target acquisition in clutter will be developed and optimized; then implementation in hardware capable of real-time processing will begin. Conceptual design, guidance and control analysis, and modeling will begin, as will development of Phase I test plans.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Advanced Seeker Technology: Critical seeker and tracker development will continue with captive flight tests in 1Q 1983 and evaluation of lock-on-before-launch, fire and forget imaging infrared seekers. Programs also pursues advanced lock-on-after-launch (LOAL) seeker technology in both infrared and millimeter wave spectra.

Electro-Magnetic Gun (EMG): In FY 1982, the final components for the EMG laboratory hypervelocity launch system were fabricated and assembled, and commissioning tests are underway. Following their completion, the laboratory system will be installed at the Army Armaments Research and Development Command (ARRADCOM), Dover, New Jersey (mid FY 1982), where a diagnostic system for the planned test series is in procurement. Engineering design is underway on critical components for a new family of compact homopolar generators, and several higher efficiency launcher alternatives will be investigated experimentally. Further experimentation is being carried out on the EMG launching of actual military projectiles (for anti-air warfare), and initial concept design studies are being

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commissioned for the first of the proposed military demonstration systems (probably an EMG artillery launcher). In FY 1983, a coordinated technology program will be run on the ARRADCOM launcher to further develop the technology base in rail gun components, projectiles, power conditioning equipment, and hypervelocity terminal ballistics. The concept designs begun in FY 1982 will be refined to identify needed critical component development, and initial design studies for other military applications will begin. Exploratory development of alternative propulsion and pulsed-power technologies will continue. In FY 1984, actual fabrication of selected components of the first EMG demonstration system will begin, and development will continue on the other application systems identified in the 1983 programs.

Advanced Seeker Signal Processing (ASSP): Development and refinement of target acquisition algorithms and their implementation in real-time capable hardware will continue. Phase I will be completed with helicopter captive flight test of the seeker/signal processor and the technology will be transitioned to the Army for Phase II development and demonstration in an advanced TGSM. No DARPA effort beyond FY 1983 is currently planned.

3. Program to Completion: Electro-Magnetic Gun (EMG): Exploratory development of the EMG technology demonstrator will continue to completion in FY 1985, with field evaluation of operational performance of the system and its potential application (to tank, artillery, or air defense guns).

Advanced Command and Control Technology: This program is an FY 1982 initiative in response to a request by the Chief of Staff, USA. Maneuver command and control requirements at battalion and lower unit levels will be analyzed, organizational and operational concepts developed, and a maneuver operations command and control simulator developed. An accelerated program for operator interface research will be initiated. These efforts will be coordinated with on-going activities at U.S. Army Human Engineering Laboratory, the 9th Infantry Division High Technology Testbed, and the DARPA/Army testbed. Maneuver operational command and control concepts will permit evaluation of Advanced Technology C³ techniques. With the Army, testbed hardware will be fabricated and evaluated as part of the operational command and control system in a brigade/battalion level field exercise. Operational concepts and testbed hardware will then be integrated by the Army for testbed evaluation. Field evaluation of testbed hardware in the testbed will be conducted and the technology transferred to the Services.

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4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
<u>Advanced Seeker Technology</u>			
--	Early FY 1983	Seeker/Tracker Captive Flight Test. (LOBL)	New Milestone.
<u>Electromagnetic Force Gun</u>			
Mid FY 1981	Early FY 1982	Assembly of EMG hypervelocity launcher.	Difficulty in contracting and procurement of unique sub-system components.
Early FY 1982	Mid FY 1982	Transfer of EMG hypervelocity launcher to ARRADCOM.	Delay (above) in completion of assembly.
Early FY 1983	Late FY 1982	Initiate development of EMG technology demonstrator.	Technology available earlier than anticipated.
--	Late FY 1985	Completion and demonstration of first prototype system.	New Milestone.
<u>Advanced Seeker Signal Processing (ASSP)</u>			
--	Early FY 1982	Phase I Project Initiation.	New Milestone.
--	Mid FY 1983	Captive Flight Test.	New Milestone.

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
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--	Late FY 1983	Transition to Army for Phase II.	New Milestone.
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Advanced Command and Control Technology

--	Mid FY 1983	Definition of advanced technology elements.	New Milestone.
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--	Late FY 1984	Demonstration of critical sub-components and advanced technology control functions.	New Milestone.
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--	Late FY 1985	Evaluation of total system concept in the ADDS testbed and transition to the user.	New Milestone.
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5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Weapons Technology and Concepts	26,429	31,617	31,175	41,100

The programs within this project are jointly funded with the Army.

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Project: #TT-3
Program Element: #62702E
DoD Mission Area: 530

Title: Naval Warfare
Title: Tactical Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The objective of the Naval Warfare project is to evaluate, analytically and experimentally, new technologies and system concepts which, if fully developed and deployed, would significantly enhance our capability to maintain effective surveillance, targeting, and control of surface and subsurface ocean areas. While continuing the emphasis on surveillance of the Soviet Submarine Launched Ballistic Missile (SLEBM) and attack submarine forces, the overall program has been expanded to address the full range of ocean warfare issues including advanced techniques for Over-the-Horizon (OTH) weapon targeting for both surface and submerged targets, and the development of more capable weapon vehicles and warheads to meet the expanding Soviet threat. The total program emphasizes the development and at-sea experimental evaluation of functional prototypes of critical technology elements or advanced system concepts prior to the commitment by the Navy of major resources in advanced and engineering development. Programs currently being conducted or recently completed follow:

Until FY 1981, Project SEAGUARD was DARPA's major initiative in exploring fundamental physical and technological limitations on long range undersea acoustic surveillance, and it included advanced signal processing research, passive receiving array technology, and active surveillance research. Although the SEAGUARD charter officially expired at the end of FY 1980, several of the constituent programs have continued with separate goals and objectives to support ongoing Department of Defense requirements. Among these are: (1) The Acoustic Research Center (ARC), to support experimental evaluation of the limits of advanced signal processing techniques in the areas of detection, tracking, and localization. Massive distributed processing capabilities,

permit real-time signal processing research and experimentation to be conducted without interfering with the routine operation of the SOSUS system. The ARC serves increasingly as a data source and testbed for advanced processors considered by the Navy for operational use and constitutes a major element in proof-of-concept demonstrations planned for the Advanced Autonomous Array (FY 1981), Ocean Tactical Targeting, and Active Surveillance Programs; (2) The Advanced Autonomous Array (A3) program, to demonstrate an advanced system concept for rapidly deployable, expendable horizontal line array sonobuoys, which incorporate in-buoy microprocessing and (3) The Active Surveillance program to quantify the fundamental limits of long-range active acoustic detection performance imposed by ocean reverberation, propagation, noise, and target strength. Additionally, a new effort in this area began in FY 1982: (4) the Long Haul Array Program is investigating the

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DoD Mission Area: 530

Title: Naval Warfare
Title: Tactical Technology
Budget Activity: 1. Technology Base

application of fiber optic cabling and telemetry techniques to the design of acoustic arrays

Finally, (5) the Optical Signal Processor and Systolic Array Processor programs apply fast optical technology and novel digital architectures to advanced signal processing algorithms needed in multi-channel processors for towed and conformal array applications.

The Naval Warfare project is seeking to expand involvement in the "end game" of ASW and the larger issue of Ocean Warfare in general. Major Tactical ASW and Ocean Warfare research programs include: (1) The Advanced Conformal Submarine Acoustic Sensor (ACSAS), which is intended to establish the basis for a new class of hull-mounted attack submarine sonars, with performance limited only by basic acoustic, hydrodynamic, and noise control considerations; (2) The Remotely Guided Autonomous Lightweight (REGAL) Torpedo program, which develops and evaluates concepts to substantially increase the projected acquisition range of advanced lightweight torpedoes

(3) The Ocean Tactical Targeting (OTT) program, which addresses the advanced technologies for acquiring and processing long range signals to provide Over-the-Horizon targeting information to tactical Navy units. This program provides the technologies necessary for target designation on an ocean basin scale; (4) The Advanced Undersea Vehicle program, which is a new initiative in which aerospace technologies are being applied to the design of a small submersible,

and (5) the Fiber Optic Sensor program, which exploits emerging fiber optic technology to demonstrate full system level acoustic sensing in both the towed array and submarine conformal array applications.

- G. RELATED ACTIVITIES: Although the project SEAGUARD charter officially expired at the end of FY 1980, coordination with the Navy on the continuing programs is carried on with representatives of the Under Secretary of Defense for Research and Engineering, the Assistant Secretary of the Navy for Research, Engineering and Systems, and the Chief of Naval Operations. The Acoustic Research Center and related Anti-Submarine Warfare (ASW) signal processing research programs are coordinated through the Naval Electronics Systems Command (NAVELEX), which provides joint Navy funding for these efforts. The Active Surveillance program is related to the NAVELEX-320 Active Adjunct Undersea Surveillance (AAUS) program, and a joint Memorandum of Agreement (MOA) has been signed

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between DARPA and the Naval Material command (NAVMAT) relative to this effort. In FY 1981, close cooperation was established with the Navy's Strategic Systems Project Office (SSPO) to explore the implications of the program's results for the vulnerability of U.S. submarines. The Remotely Guided Autonomous Lightweight (REGAL) torpedo program complements the Navy's Advanced Lightweight Torpedo (ALWT) program by pursuing advanced alternative technologies. Coordination between REGAL and ALWT is effected through the Naval Ocean Systems Center, which is the Navy's agent for ALWT and DARPA's agent for REGAL. The Ocean Tactical Targeting (OTT) program complements the Navy's Over-the-Horizon (OTH) and Integrated Ocean Surveillance programs, by pursuing the multi-sensor integration problem, and is coordinated with the Naval Electronics System Command (NAVELEX), a DARPA program agent, and the Naval Ocean Systems Center (NOSC), as technical coordinator. The Fiber Optic program is coordinated through the Navy's Fiber Optic Sensor System (FOSS) program, which is jointly sponsored by five separate Navy commands. The Optical Signal Processor and Systolic Processor programs are coordinated through the Naval Electronics Systems Command (NAVELEX) and the Naval Sea Systems Command (NAVSEA). A Memorandum of Understanding to formalize the Systolic Processor program is in review, and an MOU for the Optical Signal Processor program was signed in FY 1980. The Advanced Autonomous Array (A3) is coordinated through the surveillance office of NAVELEX, which provides funding of supporting activities at the Naval Ocean Systems Center (NOSC). Similarly, the Long Haul Array Program is also coordinated with NAVELEX, which has sponsored the development of certain aspects of the required technology base. The Advanced Conformal Submarine Acoustic Sensor program is being pursued as a joint venture by DARPA, the Office of Naval Research, and the Office of the Chief of Naval Operations (Submarine Warfare). Both Executive and Steering Committees with representation from each of these groups have been set up, and close coordination is maintained with the Navy's exploratory and advanced development programs in this area, through the Naval Sea Systems Command (NAVSEA).

- H. **WORK PERFORMED BY:** About 85% of the work is carried out by industry, 5% by universities, and 10% by DoD in-house agencies. Industrial contractors involved in research programs under this project are: Bolt, Beranek and Newman, Inc., Arlington, Virginia and Cambridge, Massachusetts; American Satellite Corp., Washington, D.C.; Stanford Research Institute, Menlo Park, California; Institute for Defense Analyses, Arlington, Virginia; Systems Development Corp., Sunnyvale, California; A. D. Little, Boston, Massachusetts; RCA, Camden, New Jersey; Sanders Associates, Nashua, New Hampshire; Systems Planning Corporation, Arlington, Virginia; Pacific-Sierra Research Corp., Santa Monica, California; Verac, Inc., San Diego, California; ESL Corporation, Sunnyvale, California; Ampex

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Corporation, Redwood City, California; Honeywell, Incorporated, Bloomington, Minnesota; Ensco, Inc., Springfield, Virginia; ORINCON Corporation, La Jolla, California; XYBION, Cedar Knolls, New Jersey; ARGO Systems, Sunnyvale, California; and Sperry Systems, Benicia, California. The universities are: University of Texas, Austin, Texas; University of California, Los Angeles, California; and University of California, San Diego, California. The in-house effort is performed by the Naval Ocean Systems Center, San Diego, California; the Naval Underwater Systems Center, New London, Connecticut and Newport, Rhode Island; the Naval Ship Research and Development Center, Carderock, Maryland and Annapolis, Maryland; the Pacific Missile Range Facility, Kauai, Hawaii; and the Naval Oceanographic Research and Development Activity, Bay St. Louis, Mississippi.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Acoustic Research Center (ARC): Since 1976 surveillance experiments and demonstrations of increasing complexity at the ARC have contributed to new processing techniques in detection, tracking, and classification for undersea and ocean surveillance.

The fields in which the ARC has contributed either directly by transition of algorithms into operational use, or by providing confidence in approaches for further development or implementation are: tracking in a multi-target environment; detect-after-track methods; data base management for the series recall, as well as for target report association and merging. One fast optical signal processor for inter-array processing has been installed and is being tested for very large open ocean searches. Two additional optical signal processors of alternative design will be installed later in FY 1982. In FY 1981 the ARC participated in the real-time data collection and post exercise analysis of the Advanced Autonomous Array (A3) major sea test. Another broad area search experiment using the fixed arrays was conducted in FY 1981, using the maximum resident computational capacity.

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The ARC participated in the Ocean Tactical Targeting (OTT) experiment providing surface and subsurface targeting for ocean warfare. The ARC continues to serve as a hub for advanced development of fixed surveillance processing algorithm development, to be transitioned to the operational SOSUS systems through commonality of processing hardware. Based on negotiations initiated in FY 1980, a Memorandum of Agreement (MOA) was signed between DARPA and the Navy in FY 1981 and will lead to transfer of the ARC to Navy management.

Advanced Autonomous Array (A3): Building on the successful microprocessor demonstration conducted in FY 1978, the full scale inbuoy processing system was designed, fabricated and tested by mid-FY 1980. An intensive set of pre-tests was conducted during FY 1980,

In October 1980, the A3 system was deployed in a full demonstration sea test and operated in conjunction with the ARC.

In September 1981, a second full scale sea test was conducted off Bermuda to collect a long time series of A3 hydrophone data.

the feasibility and promise of autonomous buoy systems with significant internal processing capability has been demonstrated.

Fiber Optic Sensor: Following successful demonstration of a fiber optic hydrophone in FY 1980, the specifications for a fiber-optic towed array and cable system have been developed. In addition, a series of detection sensors have been developed in a "glass-board" configuration.

Remotely Guided Autonomous Lightweight (REGAL) Torpedo: Initially, the REGAL demonstration vehicle, guidance computer and vehicle-control algorithms were developed and tested at the sub-system level, and the acoustic environment of the sea test area was characterized. During FY 1980, an extensive series of man-in-the-loop sea tests was conducted; design of a fiber-optic communications link between sensor and weapon was completed and torpedo fiber optic spool hardware was designed and procured.

Further, an engagement encounter model was developed, and a simulation/analysis of the parameters of the REGAL torpedo system was commenced.

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Active Acoustic Surveillance: A demonstration in 1978 detection of submarine targets was feasible of air guns were tested and improved was successfully conducted in FY 1980,

showed that long-range
Subsequently, several types
A major milestone demonstration

reverberation (from surface and bottom) proved almost nonexistent after an initial surge to botcom interference
The air guns have now passed an extensive reliability improvement program and are ready to be used in a major validation test with an actual submarine target.

Ocean Tactical Targeting (OTT): Initial tasks in the areas of sensor data fusion, artificial intelligence, sensor cueing and feedback control techniques, and data base management have been completed. The major FY 1981 objective, the completion of a data acquisition experiment was successfully achieved.

The experiment resulted in the achieving of a rich data base as well as limited real time demonstration and validation of research results.

Advanced Conformal Submarine Acoustic Sensor (ACSAS): This is a new program start for FY 1982 and thus there are no prior accomplishments. This effort will build, however, on a large existing technology base in array and hydrophone development, hydrodynamics, submarine silencing, and array signal processing.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Acoustic Research Center (ARC): In FY 1982, the ARC will continue to stress development of algorithms for large area search and localization using both fixed and mobile surveillance assets.

In FY 1983 the management of the ARC and major ARC program development will transition to the Navy in accordance with the MOA. DARPA's involvement in the ARC will then be limited to using the facility for development of specific processing algorithms and support of major surveillance programs.

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Principal thrusts for future years will include: development and validation of OTT Fusion Center software; sensor enhancements/modifications and establishment of additional communications between added tactical targeting sensors and the fusion center; and preparation for and conduct of a major, real-time OTT concept demonstration,

Optical Signal Processing: In FY 1981, three two dimensional optical processing systems were developed. In FY 1982, these systems will be integrated and individually tested in parallel with the existing digital processor at the Acoustic Research Center (ARC). All three systems will subsequently be put on line and tested against each other and the digital system. Conceptually, the optical processors should be faster than the conventional digital systems, but a major problem is to provide an output format sufficient to handle this speed. The output format question will be thoroughly addressed in FY 1982. In FY 1983 upgrades will be made to the existing optical processors and evaluations conducted to demonstrate operational significance prior to transfer to the Navy. In FY 1982, a new initiative will be started in systolic processor architecture, which will allow computationally intensive signal processing techniques to be performed in real time. After developing and producing the required VLSI electronic components in FY 1983, the technology will be demonstrated for tactical and surveillance applications.

Advanced Undersea Vehicle (AUV): Having established that the hydrodynamic configuration and energy supply are no longer pacing problems for the particular low speed, long endurance mission of interest, the program has turned in FY 1982 to a specific engineering prototype design, with emphasis on navigation and control aspects. In FY 1983 and beyond, this design will be successively refined on the basis of critical experiments, and a sea test version constructed for testing in FY 1985.

Fiber Optic Sensor: In FY 1982 the development of a fiber optic towed array Feasibility Demonstration Model (FDM) commences, the signal conditioning modules, the fiber optic receivers, and tow cable will be developed. Late in FY 1982 the tow cable will be manufactured and delivered.

integrated tow cable

In late FY 1983 the
will be given an in-water calibration test.

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Advanced Autonomous Array (A3): The FY 1982 effort is directed towards the continued analysis of the September 1981 sea test data, as well as the definition of shore display and monitoring systems for an A3 system. The program itself is at a critical juncture in FY 1982, the initial technology demonstration having been made, and further development requiring upgrade of specific aspects, such as the processing capability, the array, the telemetry system, or shore station processing. The DARPA involvement in A3 will begin winding down in FY 1982, with the technology and insight gained applied to other (new start) programs. As part of the Navy/DARPA transition process, DARPA will continue a limited effort in the development of some of the higher risk technology areas.

Remotely Guided Autonomous lightweight (REGAL) Torpedo:

The program will be heavily sea-test oriented with sea-runs becoming successively more complex as target dynamics are introduced; the newly developed brassboard sensor (a horizontal planar array) integrated and tested; and long fiber-optic communication links tested. The final demonstration test series will commence in late FY 1982

Transition of the developed technologies to the Navy will occur by end-FY 1983.

Active Acoustic Surveillance: In early FY 1982, a long range submarine detection experiment was conducted. The test was initially scheduled for early FY 1981, but delays in the fabrication of the receiving array and a requirement to expand the test have forced the delay. In FY 1982 the results of this test will be documented and analyzed with the program being transitioned to the Navy in late FY 1982.

Ocean Tactical Targeting (OTT): The OTT effort during the first half of FY 1982 will consist of analysis of the data collected during the FY 1981 demonstration. This analysis will lead to mid FY 1982 assessment of OTT concept feasibility and a decision on continuance. Given a decision to continue, major thrusts for the remainder of FY 1982 will include: expansion of the artificial intelligence effort; improvement of the fusion center to include real-time experimentation and additional tactical targeting sensor sources; development of a functional design for a prototype OTT Fusion Center; and identification of tactical targeting specific sensor modifications/enhancements necessary for cued operation.

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Long Haul Array: During FY 1982 a design for a long-haul fiber optic telemetry link is being developed. In addition the telemetry repeaters, couplers, and power systems will be selected or designed. An electronic acoustic array will be selected using existing technology.

Advanced Conformal Submarine Acoustic Sensor (ACSAS):

evolve a design for an attack class submarine sensor suite that is optimum from an acoustic detection point of view. this program seeks to

The FY 1982 program is aimed at starting efforts in the following six task areas: Operational utility, hydrophones and inner decoupler, flow noise and outer decoupler, structural noise propagation, measurement experiments and noise simulations, and beamforming algorithms. FY 1982 efforts in the above areas are to be presented in a series of technical workshops in the Spring of 1982 during which decisions and recommendations on each of the technical tasks will be made to the ACSAS program managers. These technical workshops provide the basis for detailed program planning for FY 1983.

The FY 1983 program will continue efforts on each of the six tasks identified in the FY 1982 program and, in addition, will begin to add tasks devoted towards the experimental configuration and requirements for a quarter scale model demonstration. Work will also begin on quantifying the hull and sensor design so as not to adversely impact normal ship maintenance procedures such as dry-docking and hull inspections. A major objective of the FY 1983 program will be to add naval architecture inputs so as to refine the acoustically optimized hull configuration into an operationally practical and realizable platform.

The FY 1984 program will significantly increase the work efforts on design and instrumentation for the quarter scale model demonstration. Increased program funding levels reflect this emphasis due to equipment and instrumentation requirements.

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3. Program to Completion: Acoustic Research Center (ARC): Full transition to the Navy for ARC operations support is expected in late FY 1982. DARPA expects to remain a testbed user, when necessary, as validation of new ocean warfare concepts warrant, and as the optical processing research continues.

Ocean Tactical Targeting (OTT): The effort will continue extension of freescan theory, integration of algorithms, and coding of a knowledge based system to aid resolution of correlation ambiguities. The prototype fusion center, communications network, and data display terminals will be ready to support a late FY 1984 fleet demonstration. The technology transfers will occur across the FY 1983 to mid FY 1985 time frames.

Fiber Optic Sensor: Building on the success of the prototype fiber optic tactical array module, a full scale array will be tested in the ocean environment

Optical Signal Processing: The final operational demonstration of the two dimensional optical signal processing system will be conducted in FY 1984, with transition to the Services scheduled for early FY 1985.

Long Haul Array: A long haul fiber optic array cable will be developed and demonstrated
The array will then be transitioned to the Navy for use and follow-on development

Advanced Undersea Vehicle: It is anticipated that major technological results, as well as a specialized point design for a slow-speed, high endurance vehicle will transition to the Navy in

Advanced Conformal Submarine Acoustic Sensor (ACSAS): The ultimate system design will be tested and its construction, trials, and subsequent data analysis will be the major thrust of the remaining portion of the program.

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

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Title: Tactical Technology
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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
<u>Advanced Underwater Vehicle:</u>			
---	Late FY 1985	At-sea demonstration.	New Milestone.
<u>REGAL Torpedo:</u>			
mid FY 1983	Early FY 1983	Final REGAL Demonstration and Transition to Navy.	Early success in FY 1982 field tests.
<u>Advanced Autonomous Array:</u>			
mid FY 1982	Late FY 1982	Operational Advanced Autonomous Array Tests.	Upgrading of test hardware.
<u>Active Acoustic Surveillance:</u>			
mid FY 1982	Late FY 1982	Active Surveillance Transfer to the Navy.	Completion of test data analysis.
<u>Optical Signal Processing:</u>			
---	Late FY 1982	Optical Processing Prototypes Evaluated.	New Milestone.
<u>Fiber Optic Sensor System:</u>			
---	FY 1983	Fiber Optic Sensor Towed Array Demo Test.	New Milestone.

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Title: Naval Warfare
Title: Tactical Technology
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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
---	FY 1982	Fiber Optic Sensor Tow Cable Delivery.	New Milestone.

Long Haul Array Program:

---	FY 1982	Long Haul Telemetry System Design.	New Milestone.
---	FY 1983	Long Haul Array Integration and Wet Test.	New Milestone.
---	FY 1984		New Milestone.

Acoustic Research Center:

---	Late FY 1982	ARC transitioned to Navy.	
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Ocean Tactical Targeting:

Late FY 1983	Late FY 1984	Full Scale OTT Demonstration.	FY 83 date was too ambitious.
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Advanced Conformal Submarine Array System (ACSAS):

---	Mid FY 1982	Technical Workshops on Critical Technology Areas.	New Milestone.
---	Mid FY 1983	Begin Experiment Design.	New Milestone.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

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Title: Naval Warfare
 Title: Tactical Technology
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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
---	Late FY 1983	Add Naval architectural considerations to acoustical approach.	New Milestone.
---	Late FY 1983	Go-No Go Decision on proceeding with final design.	New Milestone.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Naval Warfare	35,903	22,887	32,875	45,600

Joint Service funding for this project is provided by the Navy.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #TT-4
Program Element: #62702E
DoD Mission Area: 530

Title: Advanced Armor Technology
Title: Tactical Technology
Budget Activity: 1. Technology Base

F. DETAILED BACKGROUND AND DESCRIPTION:

The Advanced Armor Technology program is structured by demonstrating the technical feasibility of new armor and anti-armor systems concepts defined for incorporation into and by exploiting

The latter activity is designed to broaden the base of these technologies with proven concepts that will be available

The Advanced Armor Technology Program is designed for maximum flexibility, efficiency, and responsiveness by containing

specific topics within these technologies are explored to develop and demonstrate technical solutions to current-and-near term tactical problems.

G. RELATED ACTIVITIES: Coordination of current activities is maintained with the Office of the Undersecretary of Defense Research and Engineering and appropriate Service laboratories. In particular, joint program activities are conducted with the Army Armaments Research and Development Command, Army Applied Mechanics and Materials Research Center, Naval Surface Weapons Center (White Oak), Naval Surface Weapons Center (Dahlgren), Marine Corps Development and Education Command, and Air Force Armaments Testing Laboratory.

H. WORK PERFORMED BY: About 80% of this program is contracted to industry; the remaining 20% is contracted to universities and in-house government laboratories. The principal industrial contractors are: Aeronautical Research Associates of Princeton, Princeton, New Jersey; Battelle Columbus Laboratories, Columbus, Ohio; GEO-Centers, Inc., Waltham, Massachusetts; Physics International, San Leandro, California; Systems Planning Corporation, Arlington, Virginia; SRI International, Palo Alto, California; and United Technologies Corporation,

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Project: #TT-4
Program Element: #62702E
DoD Mission Area: 530

Title: Advanced Armor Technology
Title: Tactical Technology
Budget Activity: 1. Technology Base

Sunnyvale, California. An in-house laboratory effort is performed at U.S. Army Armaments Research and Development Command, Dover, New Jersey. University effort is performed by the University of California, Lawrence Livermore National Laboratory.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Recent technical activities focused on the exploratory development of

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Technical development of

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Program Element: #62702E
DoD Mission Area: 530

Title: Advanced Armor Technology
Title: Tactical Technology
Budget Activity: 1. Technology Base

In FY 1983,

technology will be transferred to the Army for Advanced Development.

Upon successful demonstration, this

Exploratory development of

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Title: Advanced Armor Technology
 Title: Tactical Technology
 Budget Activity: 1. Technology Base

In FY 1984,

An exploratory developmental demonstration of
 expanded to demonstrate
 Design studies for

will be conducted. The concept will be augmented and
 will be initiated. This

feasibility of developing
 development of advanced

will continue.

Efforts will continue to explore the
 Exploratory

3. Program to Completion: The Advanced Armor Technology Program is a continuing program. New initiatives are evaluated continually as developmental concepts are transferred to the Services and incorporated into the program.

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Late FY 1983	Demonstrate	New Milestone.
--	Late FY 1983	Complete exploratory development of	New Milestone.

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 DoD Mission Area: 530

Title: Advanced Armor Technology
 Title: Tactical Technology
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Late FY 1984	Demonstrate	New Milestone.
--	Late FY 1985	Demonstrate	New Milestone.
--	Late FY 1986	Demonstrate	technology. New Milestone.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Advanced Armor Technology	1,945	5,000	6,900	7,900

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62707E
DoD Mission Area: 530

Title: Particle Beam Technology
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in Thousands)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
TOTAL FOR PROGRAM ELEMENT	\$33,306	\$32,500	\$31,000	\$31,000	Continuing	N/A

- B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports basic research to determine the scientific feasibility of particle beam weapon concepts which have the advantages of near-speed-of-light delivery, rapid reload, and deep target penetration with a variety of kill mechanisms. The major objective of this effort is to demonstrate stable, predictable propagation of a relativistic electron beam within the atmosphere for potential point defense applications. This program also supports research on the production of low divergence neutral particle beams for potential space applications. The FY 1981 and prior year efforts were funded under the Charged Particle Beam Project, Project #DRB-1, Program Element #61101E, Defense Research Sciences.

- C. BASIS FOR FY 1983 RDT&E REQUEST: The major objective of this program is to demonstrate the feasibility of stable predictable propagation of high-power relativistic electron beams in the atmosphere over distances of military interest. Efforts to achieve this objective during FY 1983 will focus on achieving full operation of the Advanced Test Accelerator, and on continuation of theoretical and experimental beam propagation studies. Successful demonstration of the propagation of electron beams in the atmosphere with the Advanced Test Accelerator will provide the basis for decisions by the Military Departments for potential point defense applications. This program also includes research to evaluate the feasibility of generating low-divergence neutral particle beams for potential long-range defense applications.

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Program Element: #62707E
DoD Mission Area: 530

Title: Particle Beam Technology
Budget Activity: 1. Technology Base

- D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The increased funding in FY 1983 is to develop diagnostic hardware for charged particle beam research and to extend neutral particle beam research, which was transferred to DARPA from the U.S. Army Ballistic Missile Office in FY 1981.
- E. OTHER APPROPRIATION FUNDS: None.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #PB-1
Program Element: #62707E
DoD Mission Area: 530

Title: Particle Beam Technology
Title: Particle Beam Technology
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: Charged and neutral particle beam concepts are being considered for applications in a variety of advanced weapon systems. The impetus for interest in these concepts is the expectation that particle beams can deliver large amounts of energy at close to the speed of light and lethally deposit it deep within a target with high coupling efficiency. The applications for charged particle beam technology include ship defense

The potential applications for neutral particle beam systems include

The key issue for development of charged particle beam concepts is the capability to propagate electron beams in the atmosphere. Theoretical models for electron beam propagation have been developed and have been verified by low-energy experiments at sub-atmospheric densities. However, no electron accelerators of sufficient energy and current have previously been developed in the United States which would permit critical propagation experiments to be performed at full atmospheric densities. Such experiments are essential. Therefore, a major objective of the Particle Beam Technology Program is to develop the required high-energy accelerator and to demonstrate the feasibility of predictably propagating powerful electron beams to distances of military interest

Extrapolations of low energy beam propagation experiments have indicated that an electron beam having an energy of

is necessary to demonstrate propagation at full atmospheric densities. Construction of the Advanced Test Accelerator (ATA), which was initiated by DARPA at Lawrence Livermore National Laboratory (LLNL) in FY 1979 with the objective of providing such an electron beam, is scheduled for completion at the end of FY 1982. The Experimental Test Accelerator, which represents the front-end of the ATA, is being operated at LLNL as a testbed for continued evaluation of the ATA design and to perform low-energy propagation experiments.

The critical issue for neutral particle beam system concepts is the capability to generate low divergence neutral beams. Such systems consist of a source of negative hydrogen ions, ion accelerator and focusing systems, and a neutralizer which converts the high energy ion beam to a neutral beam. All of these system elements contribute to the final beam divergence and thus, the maximum effective range. The Accelerator Test Stand, which will operate is being constructed at Los

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Alamos Scientific Laboratory. This device will be used to evaluate the critical beam divergence contributions from the low energy stages of a potential neutral particle beam system depending on specific applications.

- G. Related Activities: In FY 1980 the Under Secretary of Defense for Research and Engineering approved the Particle Beam Technology Program plan which, beginning in FY 1981, consolidates the DoD particle beam efforts under the overall technical direction of DARPA. Under this plan, DARPA has assumed responsibility for both charged and neutral particle beam feasibility experiments. The Military Departments are responsible for developing those technologies which are essential in order to rapidly implement particle beam concepts once they are proven feasible.
- H. WORK PERFORMED BY: This effort is performed by in-house activities (5%), by federally funded research facilities (75%) and by industrial contractors (20%). In-house participants include: the Naval Surface Weapons Center, Silver Spring, Maryland; and the Naval Research Laboratory, Washington, D.C. Federally funded research facilities include The Lawrence Livermore National Laboratory, Livermore, California and the Los Alamos National Laboratory, Los Alamos, New Mexico. Industrial contractors include Science Applications, Inc., Palo Alto, California; SRI International, Menlo Park, California; Mission Research Corporation, Santa Barbara, California; La Jolla Institute, La Jolla, California; Maxwell Laboratories, Inc., San Diego, California; B. K. Dynamics, Inc., Rockville, Maryland; and Physical Dynamics, Inc., La Jolla, California. Approximately 90% of the program funding is directed toward charged particle beam research, and 10% toward neutral particle beam experiments.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:
1. FY 1981 and Prior Accomplishments: The Navy's Choir Heritage Program, which focused on the development of charged particle beam concepts for application to anti-ship missile defense, was transferred to DARPA in FY 1979 due to the wide range of potential applications within all Military Departments. Under DARPA direction, research efforts are focused on demonstrating the scientific feasibility of propagating intense relativistic electron beams in the atmosphere. This objective has been pursued primarily by initiation in FY 1979 of the Advanced Test Accelerator (ATA) project at the Lawrence Livermore National Laboratory.

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Project: #PB-1
Program Element: #62707E
DoD Mission Area: 530

Title: Particle Beam Technology
Title: Particle Beam Technology
Budget Activity: 1. Technology Base

During FY 1981 all major ATA procurements were placed, construction of the facility which will house the accelerator was completed, and long-term life testing with the ATA prototype acceleration module was successfully performed. Development of the advanced technology required to build this powerful accelerator was completed within the Experimental Test Accelerator (ETA) project. The ETA, which is a pulsed linear induction accelerator, was completed in FY 1979. During FY 1981, operation has been achieved at full power with acceleration and transport characteristics. This device is now being used to extend previous beam propagation experiments in low-pressure gases in preparation for experiments with ATA. In addition to developing essential experimental tools in FY 1981, detailed computer modeling of electron beam propagation has been extended in order to more fully characterize propagation and stability of single beam pulses, formation of low-density channels in the atmosphere by a series of beam pulses, and guiding of pulses within low-density channels. This work has verified previous estimates for stable propagation in the atmosphere.

Secondary research thrusts have also been pursued. A new high-voltage, high-current switch concept has been demonstrated, which offers the potential for reducing accelerator complexity and facilitating operation at higher powers. Other accomplishments include development of advanced accelerator designs, accelerator concept (the betatron) which may offer near term capability for reaching weapon-grade energies (more and analysis of new beam transport and steering concepts.

Neutral particle beam research, which was previously supported by the Army's Ballistic Missile Advanced Technology Center, was transferred to DARPA in FY 1981. The key issue for this effort is to demonstrate the ability to generate a low divergence beam of atomic hydrogen

Major accomplishments have been achieved during FY 1981 in the development of each of the major components which determine the divergence characteristics of a neutral particle beam system. Work is now underway to assemble the hydrogen negative ion source and low-energy accelerator sections in order to perform integrated

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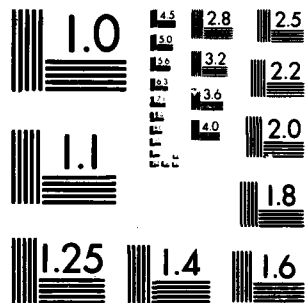
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MICROCOPY RESOLUTION TEST CHART
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FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #PB-1
Program Element: #62707E
DoD Mission Area: 530

Title: Particle Beam Technology
Title: Particle Beam Technology
Budget Activity: 1. Technology Base

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The major thrust of the charged particle beam effort in FY 1982 is completion of the construction of the Advanced Test Accelerator (ATA), which will be the essential tool for determining the feasibility of propagating electron beams in the atmosphere. The building and tunnel, which will house the accelerator, as well as most major hardware procurements, have now been completed. Operation of the Experimental Test Accelerator (ETA), is continuing to provide critical performance and life data on ATA component and system designs. Also, experiments to study beam propagation characteristics in low-pressure gases are now being performed. These experiments are designed to provide preliminary characterization of the evolution and stability of single beam pulses, and the formation of low-density channels in gases by a series of beam pulses. Comparison and iteration with the comprehensive theoretical models being developed under this program are providing a solid basis on which to assess future ATA experimental results. Research on neutral particle beam concepts is being focused on the construction of the Accelerator Test Stand (ATS) at Los Alamos Scientific Laboratory. The ATS combines a hydrogen negative ion source, a radio-frequency quadrupole injector, and a radio-frequency accelerator each of which has been individually optimized to deliver a high current ion beam with minimum beam divergence. This device is designed to facilitate critical evaluation of the growth of ion beam divergence in the low-energy stages neutral particle beam systems. Such systems would include additional radio-frequency acceleration sections, beam expansion optics, and a stripping cell to finally neutralize the ion beam such that it will maintain low divergence as it travels to a distant target.

During FY 1983 the Advanced Test Accelerator will be brought to full operation at a beam energy of

It is anticipated that electron beam propagation experiments
Neutral particle beam research will focus on completing the construction of the Accelerator Test Stand (ATS).

During FY 1984 critical propagation experiments will be initiated with the ATA beam. These experiments will concentrate on preliminary characterization of the evolution and stability of single beam pulses, the formation of low-density channels in gases at atmospheric pressure, and tracking of beam pulses in low-density channels. Understanding of these phenomena will be facilitated by comparison with comprehensive theoretical models being

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #PB-1
Program Element: #62707E
DoD Mission Area: 530

Title: Particle Beam Technology
Title: Particle Beam Technology
Budget Activity: 1. Technology Base

developed in this program. Neutral particle beam research will concentrate on performance of beam divergence experiments

3. Program to Completion: Charged particle beam propagation experiments using the original ATA parameters will be continued At that time the ATA will be upgraded to a repetition rate by retrofitting high-voltage switches which are currently under development. This will permit full assessment of the characteristics of an electron beam propagation mode which has potential military application Also during FY 1985, construction of a beam chopper will be completed and it will be installed on ATA. This device, which will spaced pulses, will permit limited evaluation of a beam propagation mode It is expected that all propagation feasibility experiments will be completed during Successful completion of charged particle beam experiments will provide the basis for decisions by the Secretary of Defense to develop Neutral particle beam efforts will focus on completion of the ATS experiments The objective of these experiments will be to demonstrate at the feasibility of achieving capability to achieve beam divergences radians at high beam energies. Successful completion of neutral particle beam experiments will provide the basis for the design of a high-energy experiment which will incorporate all of the critical elements which determine the beam divergence characteristics of a neutral beam system.

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Mid FY 1982	ETA characterization of	Concentration of ETA tests on verification of ATA design concepts have extended this milestone. Preliminary theoretical results have been achieved

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #PB-1
 Program Element: #62707E
 DoD Mission Area: 530

Title: Particle Beam Technology
 Title: Particle Beam Technology
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Late FY 1982	Advanced Test Accelerator (ATA) construction completed.	No change.
		Accelerator Test Stand completed.	This program has been delayed due to incorporation of improved ion focusing elements.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Particle Beam Technology	\$33,306	32,500	\$31,000	\$31,000

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62708E
DoD Mission Area: 530

Title: Integrated Command and Control Technology
Budget Activity: 1. Technology Base

A. (U) RESOURCES: (\$ in Thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	Total For Program Element	32,752	41,100	45,300	49,300	Continuing	N/A
IC-1	Distributed Information Systems	16,536	19,202	21,550	23,400	Continuing	N/A
IC-2	Advanced Command Control and Communications Technology	13,825	19,698	21,250	23,400	Continuing	N/A
IC-3	Systems Technology	2,391	2,200	2,500	2,500	Continuing	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of DARPA's research in Integrated Command and Control technology is to develop advanced information processing, computer-communications and system sciences technology which can provide the technology base for future command and control systems, and to demonstrate and evaluate them with the Services in selected operational environments.

C. (U) BASIS FOR FY 1983 RDT&E REQUEST: The objective of the project in Distributed Information Systems is to develop new information processing technology which will support distributed strategic and tactical requirements, and which can also exploit the inherent advantages of survivability, reliability, and expandability which are found in distributed systems. Experiments will be continued to evaluate integrated voice/data packet-switched communications over the internetwork system consisting of wideband satellites, local nets, mobile radio nets and long haul terrestrial nets. Emphasis will be placed on supporting real-time, distributed processing. Certifiable end-to-end internetwork security technology will be developed. Distributed computing systems composed of personal workstations interconnected by a high bandwidth local network will be developed and a distributed multi-media message system will be developed. Integrated programming support environments will be developed, and the use of automated software development tools will be explored.

(U) Experimentation with a six node distributed sensor network will be carried out in the field and new distributed

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Program Element: #62708E
DoD Mission Area: 530

Title: Integrated Command and Control Technology
Budget Activity: 1. Technology Base

detection and tracking algorithms tested in the laboratory. The Internetting program was transferred from IC-2 to IC-1 during FY 1982 to reflect its close coupling to the security technology development.

(U) The objectives of the project in advanced command, control and communications technology are to develop advanced computer-communication technology, and to demonstrate and transfer this technology to the Services. Two key thrusts in the communications area are to develop survivable networks and concepts for controlling and utilizing large networks. The multiple, low-orbiting satellite technology offers a survivable communication system which can be internettted with existing packet switched networks. Research in the areas of robust protocols, C3 counter measures and the reconstitution of network resources will lead to even greater network survivability. The packet radio development effort will be ending in FY 1983, but the packet radio technology is being used extensively in several testbed programs with the Services. To support these testbeds and to provide a basis for large network experiments, a low-cost packet radio is being procured. A joint DARPA/Army program now underway at Ft. Bragg, N.C. to demonstrate internetting and packet radio technology in a tactical environment will be followed by joint participation in the High Technology Test Bed (HTTB) at Ft. Lewis, Washington, where a distributed computing architecture using packet radio technology will be developed to support large scale, decentralized data access for battlefield use. A joint program with the Strategic Air Command (SAC) and the Defense Communication Agency (DCA) will develop and demonstrate the technology needed to reconstitute both communications and databases following a nuclear strike in which portions of our communication resources may be destroyed. A technology to support the rapid fabrication of VLSI circuits by geographically dispersed designers is being developed.

(U) The Systems Sciences Technology Project is developing a model of combat effectiveness and combat readiness to identify those factors having the greatest impact on national defense posture and the development of training technology and job performance aids to make improvements in those areas identified as having the greatest impact.

(U) Approximately \$2M of the growth in this program in FY 1983 is due to the local network technology program reaching critical mass. The remainder is due to inflation.

D. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

Milestone Changes

- o Certification of manually re-keyed end-to-end encryption system for use at Fort Bragg delayed until early FY 1983.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62708E
DoD Mission Area: 530

Title: Integrated Command and Control Technology
Budget Activity: 1. Technology Base

- o Implementation of a certifiable end-to-end, remotely keyable security system delayed until FY 1984.

E. (U) OTHER APPROPRIATION FUNDS: None.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #IC-1
Program Element: #62708E
DoD Mission Area: 530

Title: Distributed Information Systems
Title: Integrated Command and Control Technology
Budget Activity: 1. Technology Base

- F. (U) DETAILED BACKGROUND AND DESCRIPTION: The objectives of this project are to develop and demonstrate technology for building geographically distributed information systems which can be secured, operate in real-time and be easily expanded to meet the increasing demand for information processing in DoD command, control and communications applications. The internetting effort is developing protocols which will permit secure distributed processing among computers on different packet networks. Host and gateway software is being developed to support real-time applications and improved fault detection, isolation and recovery in the internet environment. Security and access-control techniques for internetted packet-switched networks are being developed and demonstrated, with emphasis on the interoperation of multi-level secure computer and communication capabilities. Operating system security techniques are being developed to protect classified information in highly dynamic information interchange environments. The feasibility of integrated voice/data networks is being demonstrated through the use of a wideband satellite channel connected to local networks of computers and low-cost packet voice terminals.
- (U) Program support environments are being developed to facilitate program development and the use of high level languages, such as Ada, in distributed processing applications. A distributed database methodology is being developed to consolidate existing heterogeneous databases into a single logical entity for query/retrieval. A message system architecture is being developed which takes advantage of distributed processing on local networks of personal workstations, and a distributed wargaming application involving geographically separated workstations is being explored. A distributed network of low-cost, unattended, communicating sensors, each with local processing, is under development to evaluate the system concept relative to more conventional non-distributed architectures, and to demonstrate the feasibility of highly survivable surveillance systems.
- G. (U) RELATED ACTIVITIES: Secure, compressed, digital speech efforts are coordinated through the Digital Voice Processor Consortium with representation by the Defense Communications Agency (DCA), the National Security Agency (NSA), DARPA and the Services. Overall coordination of the security efforts is maintained by OUSDRE(C3I) with DARPA responsible for the development of basic technology and architectural concepts for secure systems. Concept demonstration systems development is jointly funded or otherwise supported by DCA (PE 33126K), NSA (PE 33401G), DOD and the Defense Intelligence Agency. The Distributed Message System Architecture effort is coordinated with DCA and OUSDRE (C3I) in relation to the DOD Standard Automated Message Handling System initiative. The wideband speech experiment is being carried out jointly with DCA and the Services. The internetting effort is coordinated with DCA, RADC, NSA and OUSDRE (C3I).

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Project: #IC-1

Program Element: #62708E

DoD Mission Area: 530

Title: Distributed Information Systems

Title: Integrated Command and Control Technology

Budget Activity: 1. Technology Base

H. (U) WORK PERFORMED BY: 64% Industry, 32% University and 4% In-house. The major performers are: Bolt Beranek & Newman, Cambridge, MA; MIT Lincoln Labs, Lexington, MA; Linkabit Corporation, San Diego, CA; University of Southern California, Information Sciences Institute, Marina del Rey, CA; Carnegie Mellon University, Pittsburgh, PA; University of California at Los Angeles, Los Angeles, CA; Stanford University, Stanford, CA; Massachusetts Institute of Technology, Cambridge, MA; University of California, Berkeley, CA; and University of Utah, Salt Lake City, Utah.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: An internet protocol architecture was developed and has been adopted as a DoD standard by C3I. These internet protocols have been implemented and tested on several ARPANET host computers. A high performance microprocessor gateway was developed and used to interconnect the ARPANET with packet radio nets, packet satellite nets and local area nets, and a version of the gateway has been developed to connect ARPANET to public data networks. An internet access control system was designed for the ARPANET Terminal Access Controller (TAC). Real-time packet voice communication was demonstrated on the ARPANET, packet satellite net, packet radio net and across the internetwork using a low-cost narrowband voice terminal. A flexible array processor architecture has been developed and demonstrated using real-time Linear Predictive Coding (LPC) on the packet radio net, and a VLSI implementation of this array processor has been designed. A prototype non real-time very low rate speech system based on phoneme recognition has been developed. A wideband (3 Mbps) packet satellite channel was installed at four sites and demonstrated with point-to-point packet voice communication, and a packet speech multiplexor for connecting multiple voice terminals on local networks to the satellite channel was developed.

(U) A remotely keyed unclassified end-to-end internet security system was demonstrated and a multiple security jurisdiction technique was designed. Performance tests of the internet security concept were conducted. Design of a certifiable, end-to-end network security system for packet radio and the internet was initiated. A kernelized secure operating system (KSOS) was designed and implemented. A network-based distributed database management system was designed and implemented. An experimental system, called the National Software Works (NSW), for decentralized software system management was implemented on the ARPANET. The design and implementation of a prototype 3-node distributed sensor network was completed, and field tests begun at Hanscom Field; distributed signal processing for survivability and a position location capability to provide accurate registration of the sensor sites were explored.

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Project: #IC-1

Program Element: #62708E

DoD Mission Area: 530

Title: Distributed Information Systems

Title: Integrated Command and Control Technology

Budget Activity: 1. Technology Base

2. (U) FY 1982 Program and FY 1983/84 Planned Programs: In FY 1982, the internet system is being developed to the point that it can be regularly used by a large community of users. Tasks include developing an internet electronic message and forwarding system, converting ARPANET hosts to internet operation, completing implementation of the TAC access control and evaluating the use of public data networks in the DoD Internet system. Real-time multi-rate narrowband voice algorithms are being implemented for use in the wideband speech experiment and multi-user packet speech experiments are being conducted using the wideband satellite. The flexible VLSI array processor is being completed and the phoneme recognition rate for the very low rate speech system is being improved from 60% to 80%.

(U) A security architecture for the integrated packet voice/data internet system is being designed. An interim certifiable, end-to-end encryption system is being implemented with manual keying and will support the Fort Bragg packet radio testbed. Development of the certifiable, remotely rekeyable version is continuing. Investigation of capability-based secure systems is underway. The operating system for a distributed computing system composed of powerful single-user workstations interconnected by a high bandwidth local network is being developed, and a securable distributed message system is being designed to operate in this computing environment. A prototype system for accessing non-homogeneous databases (MULTIBASE) is being evaluated, a high-performance Ada-based distributed data management system is being developed and an advanced programming support environment is being designed.

(U) Three additional nodes are being added to the distributed sensor network, and field experimentation performed. A distributed processing environment to facilitate real-time software modification and testing will be demonstrated in the laboratory. Work on position location techniques continues and multiple target detection and acquisition algorithms are being designed and evaluated.

(U) In FY 1983, the transition to internet protocols on the ARPANET will be completed and the ARPANET Access Control System will be demonstrated. Work will begin on an internet conferencing system. An effort will begin to incorporate real-time communication, resource allocation and security techniques into the existing internet architecture. Internet performance experiments under simulated adverse conditions will be carried out. Performance monitoring capabilities on the ARPANET will be extended to include cooperating hosts. Multi-user packet voice experiments will be completed on the wideband satellite channel, and emphasis will shift to integrated voice/data applications. The wideband network will be used to support integrated graphics, file transfer and other bulk data transport applications.

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Program Element: #62708E
DoD Mission Area: 530

Title: Distributed Information Systems
Title: Integrated Command and Control Technology
Budget Activity: 1. Technology Base

(U) The interim packet radio security system will be completed, certified and delivered to the Ft. Bragg testbed. Implementation of the remotely rekeyable network security system will continue. A multi-level secure operating system based on hardware-supported tagging and capability management will be designed and implementation initiated. The initial versions of the distributed computing system and a distributed message system will be completed, and evaluation will begin. The Ada version of MULTIBASE will be completed and demonstrated with operational databases. The high performance distributed data management system will be demonstrated on a local network. The design of a distributed wargaming architecture based on natural language programming will be initiated. Tools for a programming support environment will be developed, including configuration control tools, distributed debugging aids and verification software. Initial testing of the six node distributed sensor net will be completed and improved distributed detection and tracking capabilities will be developed and incorporated. A position location capability will be integrated into the network for automated system registration. A low-cost realization of a distributed sensor network node will be designed based on VLSI technology and the low-cost packet radio. A multiple target detection capability will be developed for use with background noise and clutter, and theoretical work on the foundations of distributed signal processing will be continued.

(U) In FY 1984, the wideband network will be further integrated into the internet system by implementing "Type-of-service" routing to automatically divert high capacity, delay insensitive traffic onto the wideband channel. Network partition detection and recovery mechanisms will be installed in the internet and used to support the SAC Strategic Reconstitution experiment (see project IC-2). The remotely-keyed network security system will be completed and certified. The multi-level secure operating system implementation will be completed and performance tests initiated. Distributed computing systems will continue to be enhanced and evaluated. The distributed message system will be tested and development of a certifiably secure version of it will be initiated. The programming support environment will handle distributed Ada applications, including program creation, editing, debugging and run-time performance evaluation. The design of the distributed wargaming system will be completed and implementation initiated. The distributed database technology will incorporate both local distribution as well as geographically remote databases. Testing of the six node distributed sensor network will be carried out using mobile nodes with automated system registration. The position location capability will be refined and tested in a multipath environment; development of the low cost sensor node will be initiated. A capability for signal characterization using knowledge based artificial intelligence and signal processing techniques will be incorporated.

3. (U) Program to Completion: Integrated voice/data packet-switched network applications will be demonstrated on the

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Budget Activity: 1. Technology Base

wideband channel. The wideband satellite network will be made available for general use in multimedia command and control experiments. The certified end-to-end remotely rekeyable network security system will be deployed to secure the operation of the joint testbeds with the Services. The multi-level, secure, capability-based operating system will be certified and integrated into a multi-layer secure network. Distributed computing systems and advanced programming support environments will be field-tested with selected Service organizations. The certifiably secure distributed message system will be completed and demonstrated with multi-media messages. The distributed wargaming system will be developed and demonstrated with multiple organizations across the internet. Distributed database technology will be secured. The performance of a low-cost distributed sensor net of 6-12 nodes will be evaluated using both laboratory data and limited field testing. A multiple target detection capability will be demonstrated in a mobile environment and distributed sensor net technology will be applied to large scale tactical deployments.

4. (U) Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1982	Mid FY 1982	Complete field testing of a three node Distributed Sensor Net.	
Late FY 1982	Late FY 1982	Define and document multi-layer network security architecture.	
Late FY 1982	Late FY 1982	Complete design of a secure distributed message system architecture.	

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #IC-1
 Program Element: #62708E
 DoD Mission Area: 530

Title: Distributed Information Systems
 Title: Integrated Command and Control Technology
 Budget Activity: 1. Technology Base

Mid FY 1982	Early FY 1983	Certify manually rekeyed end-to-end encryption system for use at Fort Bragg.	Parts delivery delay. Plus delay due to Tempest testing and certification.
----	Late FY 1983	Demonstrate initial distributed computing system operating on a network of personal workstations.	New Milestone
----	Late FY 1983	Demonstrate ARPANET access control system.	New Milestone
----	Late FY 1983	Demonstrate MULTIBASE implemented in Ada with operational databases.	New Milestone
Mid FY 1983	Early FY 1984	Implement a certifiable end-to-end, remotely keyable security system.	Paced by manually keyed system.
Mid FY 1984	Mid FY 1984	Complete implementation of tagged, multi-level secure operating system.	
----	Mid FY 1984	Complete development of internet security system.	New Milestone
----	Mid FY 1984	Complete testing of six node prototype Distributed Sensor net.	New Milestone

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Project: #IC-1
 Program Element: #62708E
 RDT&E Mission Area: 530

Title: Distributed Information Systems
 Title: Integrated Command and Control Technology
 Budget Activity: 1. Technology Base

(U) Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Distributed Information Systems	16,536	19,202	21,550	23,400

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #IC-2

Program Element: #62708E

DoD Mission Area: 530

Title: Advanced Command Control Communication Technology

Title: Integrated Command and Control Technology

Budget Activity: 1. Technology Base

- F. (U) DETAILED BACKGROUND AND DESCRIPTION: The objectives of this project are to develop, demonstrate and transfer advanced command and control technology to the Services. It includes work in packet radio, advanced satellite systems, survivable networks, rapid fabrication Very Large Scale Integration (VLSI) technology and field experimentation in joint DARPA/Army and DARPA/Air Force testbeds.

(U) The packet radio effort has developed and is testing network management and control techniques to achieve reliable, fail-soft operation of a network of wideband spread spectrum radios. Techniques are being developed for utilizing and controlling large-scale packet radio networks and enhanced anti-jam, anti-spoof capabilities are being evaluated. Packet radio and internetting technologies are being evaluated at Fort Bragg, North Carolina in an operational tactical environment, to evolve innovative system concepts for the use of computers in support of future Army requirements, and to develop doctrine for distributed processing in a corps headquarters. Experimentation will include secure operation using end-to-end encryption technology developed in (IC-1). Low-cost packet radios are being procured to support experimentation with large scale networks and planned testbed activities at Ft. Bragg and Ft. Lewis. A methodology is being developed for rapid implementation of custom and semi-custom integrated circuits which permits the physical separation of the design and fabrication processes, with a goal of reducing the development time for critical Command, Control and Communication (C3) components from completed design to tested working chips to a few weeks.

(U) A strategic command and control experiment is being conducted jointly with Defense Communications Agency (DCA) and the Strategic Air Command (SAC) to evaluate the use of packet radio and distributed data base technology as a basis for providing survivable communications and for rapid reconstitution of strategic communications following a major attack. A survivable satellite network architecture consisting of multiple, low-orbiting, low-cost satellites is being explored. The system supports high bandwidth inter-satellite links and satellite to ground communication based on packet switching technology.

- G. (U) RELATED ACTIVITIES: The Packet Radio technology is being evaluated by the Army in programs at Ft. Bragg, NC and Ft. Lewis, WA. The Rome Air Development Center (RADC) is funding related efforts in distributed processing technology. The Strategic Command Control and Communications experiment is a joint effort with the Strategic Air Command and the Defense Communications Agency.

- H. (U) WORK PERFORMED BY: 60% Industry; 37% University; 3% In-house. The major performers are: Rockwell International,

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Project: #IC-2
Program Element: #62708E
DoD Mission Area: 530

Title: Advanced Command Control Communication Technology
Title: Integrated Command and Control Technology
Budget Activity: 1. Technology Base

Dallas, Texas; Bolt Beranek & Newman, Inc., Cambridge, Massachusetts; SRI International, Menlo Park, California; MITRE Corporation, McLean, Virginia; Electromagnetic System Laboratories, Sunnyvale, California; Hazeltine Corporation, Greenlawn, New York; University of Southern California, Information Sciences Institute, Marina Del Rey, California; University of Southern California, Los Angeles, California; University of California at Los Angeles, Los Angeles, California.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishment: An experimental, one cubic foot, spread-spectrum packet radio was developed and deployed in a network in the San Francisco Bay area. This packet radio network was connected via gateways to the ARPANET, and internet communication was demonstrated from fixed locations, mobile vans and helicopters. Distributed network control software was designed, and implementation initiated, to allow reliable fail-soft system operation of networks consisting of tens of nodes. An advanced packet radio with anti-jam, anti-spoof and anti-intercept features was developed and successfully demonstrated. Theoretical analyses of single and multi-hop packet-radio system performance including real-time behavior were performed. Assessments of network anti-jam, anti-intercept and anti-spoof capability were carried out analytically and through laboratory experimentation. A feasibility study for a low cost packet radio (LPR) was completed and development of a demonstration model initiated. A network-based Very Large Scale Integration (VLSI) implementation system (called MOSIS) was developed and is being used on a regular basis to interface VLSI designers to commercial NMOS semiconductor fabrication sources.

(U) A network of twenty packet radios and two internet gateways was installed at Fort Bragg to provide an operational environment for concept development and evaluation of data distribution techniques. Several field exercises were conducted (including participation in Solid Shield '81), in addition to daily operation in garrison. Application programs (including airload planning and a tactical reporting system) were written to provide an appropriate environment for system evaluation and limited airborne packet radio experiments were conducted. The Strategic C3 experiment was initiated and a high power packet radio amplifier, to increase communication range to 200-250 miles was designed for airborne use. A feasibility study of the space segment portion of the multiple satellite system was completed which showed that a survivable network of low cost satellites in low orbit could be built and deployed economically.

2. (U) FY 1982 Program and FY 1983/1984 Planned Programs: During FY 1982, packet radio network control software is being

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implemented which allows the maximum potential network size to increase from tens to hundreds of packet radios, and the performance and reliability of this software are being evaluated. Performance evaluation of the advanced anti-jam packet radio is being completed and network control architectures supporting transmission security are being explored. Mobile tests of the packet radio system are being carried out during exercises at Ft. Bragg, N.C., and development of the tactical reporting system is being completed. Initial testing of an end-to-end network security system (developed in the network security program) will be conducted with the packet radio network in preparation for its introduction to Ft. Bragg in FY 1983. Development of a low cost packet radio is continuing. The MOSIS VLSI implementation system is being extended to handle CMOS semiconductor fabrication, and approximately a dozen fabrication runs are being carried out in FY 1982 supporting both university and industrial designers. A VLSI fast turnaround testbed is being established to explore ways of decreasing the turnaround time and introducing new fabrication technology into the process. A product assurance methodology is being developed for qualifying custom-fabricated chips.

(U) Airborne packet radio experiments are being carried out with small commercial aircraft to evaluate air-to-air and air-to-ground performance for the strategic C3 experiment. Implementation of a high power packet radio amplifier for a 200-250 mile range is underway. A concept of operation for the strategic C3 reconstitution project is being developed and potential system vulnerabilities are being analyzed. Redundantly configured distributed data bases are being developed. A preliminary design of the multiple satellite system is being carried out with emphasis on design of the ground segment and design-to-cost for the space segment portion. Critical technologies for the space segment are being breadboarded in the laboratory.

(U) In FY 1983, implementation and testing of the multiple-station and stationless packet radio network control software will be completed and installed in the Ft. Bragg testbed along with the end-to-end security system. Transmission security strategies will be implemented and evaluated. Packet radio field exercises with the Ft. Bragg Testbed will be completed and the end-to-end security system will be tested during exercises in preparation for transferring the testbed to the Army. The control of large packet radio networks with time-varying spread spectrum codes will be investigated, and procurement of low-cost packet radios will be initiated to provide enough radios to support testing of large-scale distributed processing concepts at Ft. Lewis. An architecture will be designed for decentralized control of ADP resources based on the use of packet radio in the battlefield. The MOSIS system will be upgraded to support chips having two levels of metal, user authentication and protected libraries; and it will continue to be used to support both NMOS and CMOS fabrication

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commercially. Initial experiments in rapid fabrication using E-beam direct write will be conducted at the testbed. The product assurance methodology will be evaluated using the bulk CMOS technology.

(U) The extended-range packet radio amplifier will be completed for use in the strategic C3 experiment and installed on selected military aircraft. Several distributed data bases will be completed for experimental use. A feasibility demonstration of airborne access to ground data bases and command/control centers will be conducted. Initial software aids for reconstitution of communications will be developed and unclassified experiments will be conducted with SAC to evaluate the reconstitution techniques. Database replication techniques to ensure data survivability will continue to be investigated. Design of the ground segment architecture for the multiple satellite system will be completed and a laboratory implementation of a low cost satellite will be initiated to demonstrate engineering feasibility.

(U) During FY 1984, network control algorithms will be adapted to utilize the code changing features of the low-cost packet radio. Theoretical work on the control of large networks will continue, and increased emphasis will be placed on the development of survivable networks including robust protocols and C3 counter measures. An architecture for decentralized control of ADP resources on a packet radio net will be developed in conjunction with the Army at Ft. Lewis. VLSI fast turnaround fabrication services will continue to be provided over the Arpanet. Additional technologies such as gallium arsenide will be evaluated for incorporation into the MOSIS system, and efforts will be made to achieve a turnaround time of two weeks.

(U) Strategic planning aids will be developed for use in the strategic C3 program and improvements made to the reconstitution software based on unclassified experimental results. Data survivability and updating methods will be evaluated using local and remote computer access. The airborne packet network will be equipped with an interim end-to-end security system and airborne experimentation with classified data bases will replace the unclassified simulated data. Laboratory implementation of a low cost satellite will be completed and laboratory experiments conducted to test key concepts. The multiple satellite system design will be finalized for both the ground segment and space segment.

3. (U) Program to Completion: A network management system for large scale nets will be developed and evaluated. A technology base for survivable networks will be developed. A large scale packet radio network will be installed jointly with the Army to evaluate battlefield data decentralization concepts. The VLSI rapid fabrication capability will be extended to submicron dimensions. Certifiable end-to-end security technology with remote rekeying will be installed at the

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SAC testbed and classified experimentation with distributed data bases will be conducted. Advanced techniques for post-strike reconstitution of failed communication links will be demonstrated using airborne and ground-mobile platforms. A demonstration of the multiple satellite system concept will be carried out in a laboratory setting to validate the architecture and to test key concepts prior to deployment.

4. (U) Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1982	Late FY 1982	Demonstrate long range packet radio operation in military aircraft.	Delay in acquiring necessary frequency allocation
Late FY 1982	Late FY 1982	Complete development and initial field testing of prototype advanced anti-jam packet radios.	
---	Mid FY 1983	Demonstrate secure packet radio network at at Ft. Bragg.	New Milestone
Late FY 1983	Late FY 1983	Demonstration of low-cost packet radio prototypes.	

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---	Late FY 1983	Demonstrate access to distributed ground-based data from airborne packet radio.	New Milestone
---	Late FY 1984	Demonstrate communication and database reconstitution.	New Milestone
---	Mid FY 1985	Demonstrate low-cost multi-satellite communication in the laboratory.	New Milestone

5. (U) Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Advanced Command Control Communications Technology	13,825	19,698	21,250	23,400

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #IC-3
Program Element: #62708E
DoD Mission Area: 530

Title: Systems Technology
Title: Integrated Command and Control Technologies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The goal of this project is to improve the effectiveness of military personnel in accomplishing their mission - combat readiness and combat effectiveness.

Specifically, job performance aids and training technology will be developed to improve tactical performance, instant readiness, and material flow.

DoD residential training costs are estimated at \$7.2 billion dollars with 15% to 20% of DoD personnel involved in training at any point in time. These figures are exclusive of field exercising, on-the-job training, factory training, etc. Computer-based training technology will both improve effectiveness and reduce time to train, while maintaining equivalent levels of performance. It will also enable the Services to train less qualified individuals for more complex jobs. The effectiveness of computerbased training and its impact on readiness and effectiveness depends on personalized instruction and more readily available instruction. The approach taken is to develop a distributed training technology that will bring instruction to the student at the job site in the field; and to develop a training technology with novel capabilities for multi-echelon gaming, simulation, personalized and individualized instruction, on-site job aiding, all using novel applications of both micro-processor and videodisc technology.

- G. RELATED ACTIVITIES: Research in this project is coordinated with the Services' R&D and Training Commands, the National Science Foundation, the Office of Naval Research, and the Office of the Under Secretary of Defense for Research and Engineering.

- H. WORK PERFORMED BY: 90% private industry and 10% universities. The major performers include: Perceptronics, Woodland Hills, California; Honeywell, Minneapolis, Minnesota; University Studios, Hollywood, California; and Stanford University, Palo Alto, California.

- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Advanced training research involving PLATO IV (Computer Aided Instructional System) evaluation at the U.S. Army Aberdeen Proving Grounds indicated that the system was highly

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Title: Systems Technology
Title: Integrated Command and Control Technologies
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reliable (95% uptime); that system response time was well under a second with a peak load of 450 students system wide; that performance of the PLATO IV group was equal to or superior to a conventionally trained group; that time savings, compared to conventional curricula was 40%; and that student and instructor attitudes were very positive. Transfer of PLATO IV technology proceeded on schedule, and the Services picked up the funding of PLATO terminals. PLATO IV also has been offered as a product line by a commercial vendor. Three hours of personalized PLATO IV training was shown to be as effective as one day's studying from a workbook and a one hour practice period in an expensive (\$200 per hour) airplane simulator.

The recent major accomplishment has been the development of GUNNER, a small, portable, intelligent, adaptive simulator/trainer for tank gunnery. This development in distributed training technology is less than one hundredth the cost of other training simulators through the use of the latest microprocessors for training control and the novel use of videodisc technology to present pictorial displays. The principles of this trainer simulator are applicable to a wide variety of problem domains such as aircraft landings, missile firing, aerial refueling. This distributed instructional system will enable DoD to bring the "schoolhouse" to the students instead of vice versa-- a very costly and common practice. The savings here are potentially enormous. Tank gunnery was chosen as the initial problem area because of the high cost of ammunition, fuel, and tank maintenance using conventional training techniques. It is also applicable to often ignored team training and multi-echelon training, as discussed below.

In addition, efforts were initiated to extend and improve low cost, portable, training simulator technology in the following areas: development began on tank commander's training simulator which can be linked to tank gunnery training simulators using dial-up telephone lines in order to provide multi-echelon, team training; work began on the development of an A10-Maverick Missile firing training simulator and an aerial refueling simulator, the latter jointly funded with the Air Force; and major advances were made in transfer of the technology to the Services. In particular, with Army funding, 15 tank gunnery simulators have been constructed for evaluation purposes, and the technology has been extended to the Infantry Fighting Vehicle and Combat Engineering Vehicle.

Three additional developments began in FY 1981; the development of a video disk display system that allows the student to view the inside of a jeep engine from various perspectives, in order to learn how such machinery operates; the development of a personalized training movie system, with particular application to maintenance and

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operation of the weapons elevators on the nuclear aircraft carrier Carl Vinson; and the development of a voice interactive maintenance aiding device (VIMAD) that provides expert instruction at the job site, to novice maintenance technicians performing complex tasks.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The FY 1982 program concentrates in four areas. First, the newly developed technology of small, portable, personalized, intelligent, inexpensive simulator trainers using microprocessor and videodisc technology will be expanded. The technology will be made self motivating by making possible student/student competitions and student/computer competitions. Team training will be expanded beyond intertank, intergun testing training to include intertank, gunner-commander training. The technology will be expanded to new application domains, specifically completion of the A10-Maverick simulator and the Aerial refueling simulator, and the initiation of an avionics simulator and a Stinger simulator, the first such for a hand-held weapon. An experimental evaluation of the tank gunnery training simulator technology will also be performed. Second, job performance aids for maintenance will be developed. These aids, to be comfortably worn by the maintainer, provide audio visual instruction, with both speech input and speech output, for the step by step maintenance of military systems. The instructional sequence can be individually modified to provide more or less detail, specific facts, troubleshooting advice, and so on. In total, the capability available is that of having an expert maintainer at the side of the novice, constantly giving advice, instruction, hints and tips. In contrast to alternative approaches such as imbedded training, this approach does not require any modification of the existing military systems, so introduction of this new technology will not be delayed by the inevitably long cycle of inventory turnover and procurement. Further, the cost of these devices is extremely low through the exclusive use of commercially available hardware and components which, as an added advantage, can be commercially maintained. Unlike older maintenance aiding technologies, e.g., micro-fiche, this new development makes possible instantaneous updating of information from a central site using conventional telephone lines, so that the electronic maintenance manual will never be out of date. In FY 1982, the first such Voice Interactive Maintenance Aiding Device (VIMAD) will be delivered, and improvements will be made in a second generation based on maintainer evaluation. Third, videodisc technology is being used to make possible interactive and personalized training movies for DoD personnel, allowing the student to see the level of detail that is desired, abstract or concrete representations, special background information, and so on. In FY 1982 one such test system will be completed for training operation and maintenance of aircraft carrier weapons elevators, a major and often troublesome component; the particular

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application is on the nuclear carrier Carl Vinson. Fourth, videodisc technology is being used in a novel fashion to display to the student the workings of complex military systems as a step toward operation and maintenance of those systems. Specifically, a display will be completed to illustrate the workings of a standard jeep engine allowing the student to view the interior of that engine while it is operating--along every water path, oil path, fuel path, and electrical conduit. The display alternates between a photographic representation and an easier-to-understand but less realistic animation representation. In FY 1983 the effort in low cost portable training simulators and voice interactive maintenance aiding devices (VIMAD) will be continued. Specifically, the improved version of the A10-Maverick missile firing training simulator will be completed, as will the previously initiated simulator developments in avionics and hand carried weapon systems - the Stinger. Most importantly, an effort will be completed to identify the techniques for significantly decreasing the manufacturing costs of these training simulators so that their use in large numbers can be wide-spread throughout the Services. In the area of VIMAD, there will be two major developments. The technology will be extended to a team VIMAD that will provide instruction to a group of novices simultaneously maintaining complex military machinery where coordination among the maintainers is critical for effective servicing. In addition, the technology will be extended to provide a surrogate maintenance capability for learning to maintain equipment which is not available for training purposes. There is typically a long time delay after weapon systems are first introduced before they are available for widespread maintenance training, and hence a subsequent delay before adequate numbers of maintenance personnel are available. Through the use of video disk-based surrogate maintenance training, it will be possible to both introduce the weapon systems and train the maintenance in parallel, thus significantly reducing inefficiency. In parallel with these technical developments, technology transfer is scheduled: training simulator technology to the Army (tank gunnery) and Air Force (aerial refueling); maintenance aids to the Air Force for aircraft landing gear and missile maintenance; interactive movies to the Army; and "microtravel" systems to the Army and Air Force.

In FY 1984 distributed training technology development will concentrate on integration of the new technology with DoD training systems; extension of the technology to use computer generated displays based on fractals; and extension of the technology to use small, portable, touch sensitive flat screen television displays in concert with digital optical disks.

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3. Program to Completion: This research will continue to respond to defense needs, with program content determined by research results, technology options, and readiness/effectiveness issues.

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
late FY 1982	late FY 1982	Complete realistic tests of new job performance aids and ultra-low cost simulators and assess their impact on Armed Forces readiness and effectiveness	
late FY 1982	late FY 1982	Demonstrate multi-echelon simulator-trainer.	
--	late FY 1983	Completion of Stinger Trainer.	New Milestone.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Systems Technology	2,391	2,200	2,500	2,500

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Program Element: #62711E
DoD Mission Area: 530

Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in Thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
TOTAL FOR PROGRAM ELEMENT		<u>\$199,449*</u>	<u>\$237,040*</u>	<u>\$268,500*</u>	<u>\$375,554*</u>	<u>Continuing</u>	<u>TBD</u>
EE-2	TEAL RUBY Experiment	25,418	27,000	22,400	20,000	6,100	143,829
EE-3	X-Wing	3,800	6,278	7,500	14,500	60,000	92,078
EE-4	Advanced Command and Control Architectural Testbed	4,049	2,300	-0-	-0-	-0-	12,202
EE-5	Technology Assessments	1,347	940	1,700	1,854	Continuing	TBD
EE-6	Advanced Sensor Demonstration	14,307	23,245	50,100	68,500	297,500	477,952
EE-7	Space Acquisition, Tracking and Pointing Experiment - TALON GOLD	17,130	25,800	35,000	58,400	128,400	275,136
EE-8	High Power Chemical Laser Ground-Based Demonstration - ALPHA	17,001	20,500	21,800	31,700	67,600	168,001
EE-9	Forward Swept Wing Demonstration	7,129	24,000	37,000	23,000	5,000	102,329

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Title: Experimental Evaluation of Major Innovative Technologies
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Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
EE-10	Assault Breaker Demonstration	69,179	21,469	-0-	-0-	-0-	165,134
EE-11	BETA/CELT Demonstration	930	-0-	-0-	-0-	-0-	7,770
EE-12	Large Optics Demonstration Experiment - LODE	6,774	15,200	14,200	22,200	45,000	135,251
EE-15	SORAK Demonstration (Korean Equipment Upgrade)	-0-	5,000	10,000	10,000	50,000	75,000
EE-16	Submarine Laser Communication	-0-	-0-	-0-	40,500	334,100	374,600

*Total includes classified projects not identified herein.

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

TEAL RUBY Experiment: This is a space experiment to demonstrate infrared detection of strategic aircraft from a space platform, to measure target and clutter background signatures from space, and to demonstrate advanced infrared detector technology. Expansion of the basic sensor mission is being investigated to include signature measurements of The sensor and the associated USAF spacecraft
are for a FY 1984 launch date aboard the space shuttle.

X-Wing: The X-Wing is a major innovation in Vertical Takeoff and Landing (VTOL) aircraft design which, by stopping the rotor in flight, combines the vertical lift efficiency of a helicopter with the speed, range, and

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altitude performance of a transonic fixed wing aircraft. Design analysis indicates an operational X-Wing vehicle would have approximately three times the speed, range, and altitude performance of a conventional helicopter with equivalent payload lifting capability. Such characteristics portend a very broad operational applicability such as: more flexible sea-basing for the Navy wherein two or more aircraft on non-aviation ships could conduct long range anti-submarine warfare, over-the-horizon targeting of surface and air targets, tactical jamming and other existing (or emerging) missions; new Army roles such as close air support and sensor carrier with intratheater, self-deployment capabilities; new Air Force tactical missions which release dependence on fixed Air Bases and increase pre-launch survivability.

Advanced Command and Control Architectural Testbed (ACCAT): The ACCAT testbed is scheduled to be completed during FY 1982 and the technology will be transferred to the Navy.

Technology Assessments: The primary objective of this project was to provide modest funding support for research initiative on new ideas which fall outside of the current on-going DARPA thrusts and program areas. These new ideas which may originate from within or outside of DARPA, are presented to and acted upon by a review council chaired by the Deputy Director of DARPA. After initial exploration, and subject to research results, the project may be continued by one of the DARPA technical offices or the results made available to one of the Military Services for exploitation. Beginning in FY 1983, these funds are now contained in Strategic Technology PE #62301E and Tactical Technology PE #62702E.

Advanced Sensor Demonstration: The purpose of the Advanced Sensor Demonstration is to experimentally demonstrate the High Altitude Large Optics (HALO) concepts for advanced strategic surveillance sensors and the HALO advanced sensor technologies in space environment. A late 1980's flight of the Mini Halo sensor will permit high payoff alternative technologies to be considered when decisions are made in the late 1980s to initiate development of the nation's new generation of strategic infrared surveillance sensors.

Space Acquisition, Tracking & Pointing Experiment - TALON GOLD: The goal of the TALON GOLD Project is a space test of laser pointing technology. The experiment is designed to achieve long range with pointing accuracies and beam stabilization of better than

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. This is a key element in the development by DARPA of space-based high energy laser technology required for

High Power Chemical Laser Ground-Based Experiment - ALPHA: The objective of the ALPHA Project is the demonstration of the feasibility of a

. Emphasis in this effort is placed on the ground-based test and evaluation of a

Forward Swept Wing: A manned Forward Swept Wing (FSW) aircraft, made possible with advanced composite structure and a digital fly-by-wire flight control system, will be designed, fabricated, and flight tested to investigate and quantify the aerodynamic benefits and performance capabilities of an integrated advanced technology vehicle. Significant improvement of short takeoff and landing (STOL) performance, excellent high angle of attack maneuver control, more efficient transonic performance, and considerable design flexibility are the most obvious advantages of this unique configuration. These FSW technology attributes will lead to major reductions in the weight and costs of future vehicles. Flight test will develop confidence in numerous individual technologies, make them available as viable design options for advanced vehicles, and greatly reduce the risk and time associated with future application.

Assault Breaker Demonstration: The purpose of the Assault Breaker Program is to develop, demonstrate, and evaluate the technologies required to deny the Warsaw Pact its second echelon reserve and exploitation forces by demonstrating a capability for standoff acquisition and destruction of armored formations at ranges as great as beyond the Forward Edge of the Battle Area (FEBA). This effort includes Assault Breaker ground and air launched missiles, terminally guided submunitions and Pave Mover radars. Successful completion of the demonstrations would provide a basis for decisions on engineering development for the Pave Mover radar by the Air Force and Corps Support Weapon System by the Army in late FY 1982/early FY 1983.

Large Optics Demonstration Experiment (LODE): The objective of this program is to demonstrate in a ground-based experiment the performance obtainable from a laser beam control system coupled to a large

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aperture beam expander designed for . Issues related to wavefront control and internal alignment, large optical structures, sub-microradian fine tracking and internal energy management will be addressed.

SORAK Technology Demonstration: This project will demonstrate a near-real-time intelligence, early warning and targeting system based upon multiple high technology sensor platform inputs, survivable communications and computer aided target analysis and fire planning. The very unique and severe warning and indications problems makes this technology highly important. The overall SORAK system is expected to be ready for a full system demonstration in late FY 1984 or early FY 1985.

- C. BASIS FOR FY 1983 RDT&E REQUEST: The FY 1983 funding for TEAL RUBY will be used to complete the flight sensor acceptance testing and integration testing with the spacecraft. Software will be completed for command generation, data reduction, and quick look data analysis. These activities represent major milestones toward achieving a launch in early FY 1984.

X-Wing: The objective of this program is to design, fabricate and flight test a demonstration vehicle of a size representative of an operational aircraft. The FY 1983 program is structured to narrow from two contractors to one who will detail design, fabricate and test a flight demonstrator. Various program options are currently under study ranging from a lower cost, DARPA-only approach using the existing Rotor Systems Research Aircraft (RSRA) and a more ambitious, but more capable, all new demonstrator vehicle configured around the DARPA/NASA/GE Convertible Engine. The FY 1983 funding request will initiate the selected option.

The Advanced Sensor Demonstration program will demonstrate the capability for in an operational environment. The sensor, to be placed in orbit in the late 1980's, will incorporate advanced technology infrared focal plane components and a long life - high capacity cryogenic refrigerator. In FY 1983, pre-prototype element detector arrays designed to flight specification will be tested and demonstrated. Endurance testing of the long life turborefrigerator will be continued to develop a reliability model. Extensive endurance test time on the flight design refrigerator will be required to assure that the orbital life specification of 2 1/2 years minimum is met. Onboard signal processor software and custom device development will be completed and processor performance demonstrated.

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The funding for TALON GOLD will continue the Phase II portion of the program for detailed design, fabrication, testing, and purchase of long-lead hardware consistent with a post launch. Experiment content will be definitized and detailed design will be approximately 40% complete.

ALPHA funding will complete the detailed design of the laser subsystem with the Critical Design Review to be conducted. Subsequently, fabrication of the laser will be initiated, the detailed design of the test facility will be initiated and long-lead materials for the facility will be ordered.

In FY 1983, the Forward Swept Wing aircraft fabrication will be completed. All systems of the flight vehicles will be ground tested, proof and load tests will be completed and the X-29A will be cleared for flight.

LODE funding is to complete the preliminary design of the LODE experiment and risk reduction breadboard activities at the component or subsystem level. The preliminary design of test and simulation facilities will also be completed.

FY 1983 funding for the Indirect Fire Cannon program is requested to develop the full scale technology demonstrator for an extended range, autonomous terminal homing cannon, artillery projectile in preparation for a flight test evaluation in late FY 1983/early FY 1984.

FY 1983 funding for Advanced Seeker Technology (formerly Tank Breaker) is contained in the TT-2 program.

The FY 1983 funding for SORAK will be used to continue hardware development of the various sensors, and other equipment as well as continuing the system software development for the demonstration.

D. COMPARISON WITH THE FY 1982 DESCRIPTIVE SUMMARY: FY 1982 and FY 1983 requirements for the TEAL RUBY program have increased due to delayed availability of critical electronic parts, expanded testing of subsystems, and enhanced mission planning. The FY 1981 Assault Breaker Demonstration program has increased as a result of inclusion of funds for the experimental evaluation of the Pave Mover radar and for support of the air launched phase of the demonstration. Major milestones for the Advanced Sensor Demonstration program have slipped one year

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to accommodate funding requirements in other EEMIT programs and extended contracting processing. The FY 1985 X-Wing program has been restructured during FY 1981 to a larger scale vehicle (50 foot diameter, 20-30,000 pounds) with competitive contractor selection early in FY 1983. The FY 1982 funding requirement for the Forward Swept Wing program is reduced because of a slip of four months in major program milestones. FY 1982 funding for Advanced Indirect Fire Cannon has been transferred to the Tactical Technology PE62702E Project TT-2 to further pursue on Lock On After Launch (LOAL) seeker technology and its validation prior to initiating weaponization demonstration activity. In the FY 1982 Descriptive Summary Tank Breaker was included in the experimental evaluation program. However, now the FY 1982 and the FY 1983 funding is contained in the TT-2 program. The FY 1982 and 1983 funding for TALON GOLD has been increased due to Phase II program definitization in FY 1981. The FY 1982 and FY 1983 funding for ALPHA has decreased due to program restructuring and stretchout. The FY 1982 and FY 1983 funding for LODE has decreased due to program restructuring and stretchout. The FY 1983 funding requirement for the Forward Swept Wing program is increased to procure the second flight vehicle and to enhance the instrumentation system of the experimental aircraft. The SORAK technology demonstration is a new start in FY 1982.

E. OTHER APPROPRIATION FUNDS: None

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Project: #EE-2
Program Element: #62711E
DoD Mission Area: 530

Title: TEAL RUBY Experiment
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: DARPA initiated the TEAL RUBY Program in 1974 (P.E. 62301E, Project ST-6) to develop conceptual designs and technology for infrared sensors as an alternative to the Over-the-Horizon (OTH-B) radar for strategic bomber warning. Currently, sensor and spacecraft hardware are being developed for FY 1984 launch of the TEAL RUBY Space Experiment. This experiment will demonstrate the feasibility of strategic air vehicle detection from space and make available to the DoD the option for providing bomber or Fleet Defense warning from infrared space-based sensors. The success of the focal plane technology in producing mosaic arrays with detector elements and integrated charge coupled device readout made feasible the experiment design and planning. The weak signatures of strategic aircraft and the strong background clutter made the use of staring mosaics essential to provide the integration times of necessary for high probability of detection at low signal-to-noise ratios. Target and background measurements performed under the TEAL RUBY Program showed that spectral discrimination of targets using

This approach will be tested on the TEAL RUBY Space Experiment using 13 fixed narrow band infrared spectral filters in the wavelength band with corresponding focal plane zones containing detectors. Two detector zones were to be developed with spectral filters to demonstrate that spectral can be accomplished with a single focal plane as well as to test this concept as a spectral filter capability was demonstrated successfully in the laboratory but will not be flown as part of the space experiment due to cost and schedule considerations. Measurements will be performed from a 740 kilometer orbit at an inclination of 75 degrees using cooperative target aircraft to validate design methodology. The sensor is designed with sufficient sensitivity to provide data of radiometric quality on strong targets such as strategic bombers and to demonstrate the ability to detect and track targets such as cruise missiles. Infrared background measurements, required for the design of future operational sensors, will be made on a worldwide basis and under a variety of climatological and geographic conditions. Plans are being formulated to conduct a limited number of experimental missions from orbit demonstrating the utility of advanced infrared space sensors to support theater missions including fleet air defense. In addition, the feasibility of the sensor to measure is being examined.

- G. RELATED ACTIVITIES: Development of the focal plane technology, target and background measurements from aircraft platforms, and definition and preliminary design of the flight experiment were accomplished under the

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DARPA Warning Technology Project, Program Element 62301E, Project ST-6, prior to FY 1979. The TEAL RUBY Experiment provides the transition of DARPA concepts and technology for strategic aircraft detection to the USAF Air Vehicle Detection Program. Data and technology results will be made available to the USAF Missile Surveillance Technology Program, the Navy Space Project Office, Army Space Project Office and other Government organizations.

- H. WORK PERFORMED BY: 95% of this program is industrial effort and 5% is Federal Contract Research Center (FCRC) support. Rockwell International, Seal Beach, California, is the prime contractor on the TEAL RUBY sensor; support contractors are IBM, Westlake, California; Center For Analysis, Irvine, California; and Photon Research Association, La Jolla, California. Federal Contract Research Center support is provided by the Aerospace Corporation, El Segundo, California. The program is monitored by the Air Force Space Division, Los Angeles, California with support in Naval areas of interest by the Naval Oceans Systems Command, San Diego, California.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The technology development and sensor definition were completed under the Warning Technology Project ST-6 in Program Element 62301E. Competitive design programs were conducted through Preliminary Design Review in April 1977 when the prime contractor was selected to build and support on-orbit operation of the sensor. A mass-volume dynamic simulator was fabricated and tested to verify subsystem environmental levels. An interface control document has been developed and signed by the USAF Space Division Directorate of Technology, which has the responsibility for procurement and technical direction of the TEAL RUBY Space Experiment for DARPA, and the Space Test Program Office, which has contracted for the P80-1 spacecraft to be launched into initial orbit with the TEAL RUBY sensor by the Space Transportation System (Shuttle). The qualification model cryogenic TEAL RUBY infrared telescope has been fabricated, optically tested, subjected to acoustic and thermal test environment and delivered to the prime contractor. A contamination control seal between the two telescope cavities has been incorporated into the design in the form of a Zinc Selenide window. Production of the two extrinsic silicon detector device types is nearing completion with the devices exceeding the performance specifications. All detector arrays have been qualified (using a fully automated chip tester) for integration into the qualification sensor focal plane, and the first focal plane zone has been assembled and tested. The automated detector array test set has been fully certified and

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detector arrays to satisfy flight model sensor and space requirements have been tested and inventoried. Successful space qualification of these first generation detector arrays will confirm the maturity of the DARPA mosaic arrays for future DoD surveillance applications. Qualification models of the precision gimbal system have completed qualification testing and met all specifications on the mass volume simulator. The qualification model cryostat has been space qualified and the flight model device is being fabricated. The system controller and data processing qualification units have been fabricated, checked out and are in space qualification. The space system computer model has been completed and dynamic motions of the sensor and spacecraft calculated; the results led to redesign of the earth shield to prevent vibration from that subsystem. A mission planning group has been formed for on-orbit operations and the first space experiment plan (SEP) has been published.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The qualification sensor will be assembled for integration testing during FY 1982. The flight sensor is being fabricated. The qualification unit will be provided for preliminary integration with the space craft in early FY 1983 and replaced in mid FY 1983 with the flight sensor. Actual launch is planned for early FY 1984 but is subject to uncertainty in Space Transportation System scheduling and manifesting. During FY 1982 the component qualification testings will be completed, and the components integrated into a complete sensor. Results from system level testing of the sensor focal plane and sensor qualification test, will provide the first comprehensive data of expected on-orbit performance to guide development of mission planning and command software. Completion of detector array production is being accomplished with sorting of the arrays by measured responsivity, noise and uniformity levels. The focal plane is composed of each of which require slightly different specifications for optimum on-orbit performance. Mission planning activities are being closely coordinated with the USAF and NAVY Aircraft Surveillance requirements to assure collection of data for the design of an operational spaceborne Air Vehicle Detection System. Sensor qualification tests will be completed in FY 1982. To assure a realistic test at appropriate induced environmental exposure levels the final acceptance test will be done at the integrated sensor-spacecraft level. Software will be completed for Mission planning including command generation data reduction and quick look "data analysis." The data reduction software will provide the capability to generate computer compatible calibrated research tapes to be turned over to the Services for their analysis effort. The development and validation of software for mission execution, data processing and reduction will be a major milestone in mosaic sensor development since the data rate of these sensors exceeds that of conventional infrared surveillance sensors

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by The data analysis software being developed is based upon the experience and software generated by the High Resolution Calibrated Airborne Measurement Program sensor and in turn will provide the basis for still more capable software packages such as that required to support the Advanced Sensor Demonstration Program.

In FY 1983 the integrated system test will be completed, the system packaged and delivered to Cape Canaveral for final shuttle integration and launch in early FY 1984. After insertion into final orbit the TEAL RUBY sensor subsystem will be checked out and orbital experiment operations initiated. Experimental missions will be conducted for nominal time periods of twice a week, corresponding to orbital passage over targets and/or background areas of interest. Experiment segments or missions are generally categorized as: (1) target missions during which on-board detection of a cooperative air vehicle target will be demonstrated while full radiometric data is simultaneously recorded for subsequent transmittal to the ground network; and (2) background missions during which multispectral radiometric data in two dimensions will be recorded for subsequent transmittal. Priority in time sequence of experiment execution will be given to aircraft/measurement/detection and collection of global background data with emphasis on Northern Geographic regions and those geographic areas of interest for the various missions. Assessment of the focal plane technological maturity will be carried out by monitoring and analyzing a variety of temperature, signal and noise levels within the sensor system. Early mission assessment will be conducted via the "quick look" analysis capability and modifications made as necessary to the mission plan. Redesign of the on-board processing and signal conditioning units in FY 1982 together with the availability of parts have caused cost growth in FY 81-83, together with a significantly expanded mission planning and operations effort.

3. Program to Completion: The estimated life of the TEAL RUBY Sensor, limited by the supply of stored solid cryogen, is one year or a nominal mission completion date of mid FY 1985. A final experiment evaluation report will follow mission completion by six months, late FY 1985.

4. Milestones:

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Title: TEAL RUBY Experiment

Title: Experimental Evaluation of Major Innovative Technologies

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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1982	Mid FY 1982	Complete fabrication of TEAL RUBY Sensor and deliver to USAF/Space Division Spacecraft.	Change in launch date and test schedule due to parts availability and processing unit redesign and fabrication difficulties.
Mid FY 1983	Early FY 1984	Launch.	Change in launch date and test schedule due to parts availability and processing, unit redesign, fabrication difficulties, and shuttle launch availability.
Mid FY 1984	Early FY 1985	Terminate Orbital Operations.	Change in launch date.
Early FY 1985	Mid FY 1985	Finish evaluation of sensor performance and complete program.	Change in launch date.

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
TEAL RUBY Experiment	25,418	27,000	22,400	20,000

This program is a joint DARPA-USAF program with DARPA responsible for the TEAL RUBY sensor and the USAF responsible for the spacecraft, launch and detailed data analysis.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-3
Program Element: #62711E
DoD Mission Area: 530

Title: X-Wing
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The X-Wing is a major innovation in Vertical Takeoff and Landing (VTOL) aircraft design which, by stopping the rotor in-flight, combines the vertical lifting efficiency of a helicopter with the speed, range and altitude performance of a transonic fixed wing aircraft. This unique capability is made possible through the use of a quasi-elliptical circulation control airfoil in the design of the rotor blades. The lift on each rotor blade can be selectively controlled by varying the momentum flux of air blown through tangential slots along each rotor trailing edge. The X-Wing aircraft uses the circulation control system to produce lift and achieve stability and control of the vehicle during all flight modes including in-flight stopping/starting of the rotor/wing. The objective of this effort is to demonstrate the utility of the concept through the design, fabrication and flight test of a demonstration vehicle representative of an operational size aircraft. Emphasis was changed in FY 1980 to an operational size aircraft from the original 3,200 lb test vehicle. A twenty five foot graphite composite rotor and active fly-by-wire flight control system has been successfully tested in the NASA Ames 40 x 80 foot wind tunnel. Preliminary design of a larger operational scale rotor system and compatible airframe has been initiated. Design analysis indicates an operational X-Wing vehicle would have substantially greater range, speed and altitude than a conventional helicopter with equivalent payload lifting capability. These characteristics portend a very broad operational applicability. For example, they could greatly enhance Navy missions such as early warning, antisubmarine warfare, and over-the-horizon targeting and could also make new missions possible such as long range Surface Launched Air Targetable (SLAT) missile anti-air warfare, dispersed electronic jammer and missileer missions. Preliminary studies of multi-mission X-Wing designs employing fifty foot diameter rotors and convertible fan/shaft engines indicate an excellent potential for non-aviation ship compatibility. Other analyses and test data verified a capability for significantly improved handling qualities during turbulent shipboard takeoff and landing operations. The extended range and speed capability of the X-Wing enhances its operational utility for Air Force, Navy and Coast Guard extended range Search and Rescue missions as well as troop insertion and personnel evacuation roles. Cumulative findings strongly support the X-Wing as an ideal vehicle to provide the flexible sea basing and deployment options sought by the Navy. Potential Army missions include Special Equipment Mission Aircraft (SEMA-X), Scout Attack (LH-X), new/Close Air Support missions, Anti-Air, intratheater transport and cross-FEBA interdiction. The X-Wing also appears capable of providing a measure of self-deployment ferry capability for Rapid Deployment Force applications.

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Title: X-Wing
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- G. RELATED ACTIVITIES: The X-Wing Vertical Takeoff and Landing (VTOL) initiative is derived from the Circulation Control Rotor work performed earlier by the David Taylor Naval Ship Research and Development Center (DTNSRDC) and also takes advantage of advanced stopped rotor dynamics and control work done by the Army in the late 1960s. The Navy is using a 44 foot diameter Circulation Control Rotor in a current flight test program on the UH-2D helicopter for the purpose of demonstrating improved reliability, maintainability and active vibration suppression. Also, the wing of an A-6 aircraft was modified by the Navy to demonstrate a Circulation Control Wing for Short Takeoff and Landing (STOL) performance improvement and completed a very successful flight test program, during which minimum landing speeds were reduced from 120KTS to 75KTS. A joint DARPA/NASA convertible turbofan/shaft engine program is being conducted in a parallel effort to provide a new and more efficient propulsion system for the X-Wing program as well as other Vertical Takeoff and Landing (VSTOL) aircraft and advanced compound rotorcraft concepts.
- H. WORK PERFORMED BY: About ninety percent of the X-Wing program is being performed by industry. Ten percent of the work is being conducted by the David Taylor Naval Ship Research and Development Center, Carderock, Maryland. The two prime contractors are the Boeing Vertol Company, Philadelphia, Pennsylvania; and Sikorsky Aircraft Company, Stratford, Connecticut. Lockheed Aircraft Corporation, is providing technology base data and whirl test facilities.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:
1. FY 1981 and Prior Accomplishments: In FY 1976, the key high risk technology questions of the concept were identified by an advisory group of aeronautical experts. Technology issues included the ability to operate efficiently both as a helicopter and as a fixed wing aircraft and to convert in a controllable manner from one mode to the other. Analysis and sub-scale wind tunnel testing conducted in FY 1977 and FY 1978 produced a high level of confidence in the addition to lab/proof testing of critical rotor blade components. A 25 foot diameter flight worthy rotor sub-assembly and a simulated fuselage were successfully tested in the Ames Research Center's 40 x 80 foot wind tunnel during FY 1979. The tests conclusively demonstrated the capability of the fly-by-wire "Hub Moment Feedback" flight control system to actively stabilize and control the rotor during the rotary/fixed wing and conversion modes of operation. Adequate rotor lift was also achieved during all flight conditions. More than 30 start/stop conversions were performed. Whirl tower testing demonstrated the system's excellent control power,

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damping and automatic gust suppression capability and indicated a significant potential improvement in low speed Vertical Takeoff and Landing (VTOL) handling qualities. Transonic testing of a quarter scale model of the complete configuration was conducted to investigate the high speed characteristics of the aircraft. Continual correlation of theoretical analysis and test data was accomplished to refine prediction methods for the performance of an operational X-Wing vehicle. An intensive technical review by DARPA/NASA/Navy personnel confirmed the 40 x 80 foot wind tunnel test results and the readiness of the program to proceed to a flight demonstration. These significant technical successes, recognized program maturity, and broad potential operational applications led to a complete restructuring of the X-Wing program at the direction of the Deputy Under Secretary of Defense Research and Engineering during the third quarter of FY 1980. The restructuring objectives were to allow for a flight assessment of the concept with operational similitude and to generate substantial incentive for strong competition within the helicopter industry in this program. Key elements included preliminary design of a flight vehicle, development of a larger circulation control rotor and initiation of an engine program to modify an existing engine for X-Wing compatibility. A competitive procurement strategy was also adopted.

2. FY 1982 Program and FY 1983/FY 1984 Planned Program: In response to the restructuring directive, initial competitive efforts began during the last quarter of FY 1980 with Boeing Vertol and Sikorsky Aircraft receiving six month contracts for 'X-Wing Technology Transfer and Assessment.' During this period a massive technology transfer activity was conducted. An engine modification tradeoff study was also conducted during this period. Upon completion of these preliminary activities the restructured X-Wing program was formally initiated in the third quarter of FY 1981 with 'Phase 1: X-Wing Flight Demonstrator Design Definition.' This activity is currently well underway with both companies performing preliminary designs of operational size flight demonstrator vehicles configured around the TF-34 Convertible Engine (discussed below). Both companies are conducting detail design studies of the rotor dynamic system including composite material blades, hub and root retention system, moment-feedback control system and selected drive train components. Boeing is fabricating a 1/5 scale, 10 foot diameter rotor/fuselage dynamic model for initial testing during the second quarter of FY 1982. This model will be used to examine various configurations and flight modes in the Boeing V/STOL wind tunnel. The full scale vehicle fidelity and sophistication of this model are such that, following an extensive test program, a high confidence commitment to a flight article can be made. Multiple tunnel entries are planned and all data obtained will be provided to Sikorsky to achieve maximum program effectiveness. In other areas both companies are fabricating critical

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structural components of the rotor blade airfoil structure, hub system and pneumatic control valve. Sikorsky is performing extensive analysis of high frequency blowing for vibration control. DTNSRDC is supporting contractor activities by conducting transonic airfoil tests and fixed wing mode stability tests of a 1/8 scale model. Recent fixed wing tests by DTNSRDC on this model with an improved rotor hub fairing have shown major advances in performance with maximum lift to effective drag ratios approaching 12.0 (on the same order as a fixed wing airplane) and significant rotor hub lift contributions in the conversion flight mode. The extension of the X-Wing demonstrator size objectives requires an expansion of the data base to higher tip speeds and pressure rotors. As part of the data base expansion activity the original 25 foot diameter rotor system will be tested further by Lockheed under a DTNSRDC run program. Both Sikorsky and Boeing will participate in this activity. Program planning activities by both companies consists of examination of a range of flight demonstrator options.

Key areas to be investigated with these vehicles could include: (1) the in-flight aerodynamics associated with the Circulation Control boundary layer control system; (2) the capability of the pneumatic control system to provide flight control, vibratory airload suppression and gust control - particularly during conversion to fixed wing flight; (3) the performance of the closed loop fly-by-wire stabilization and control system in all flight modes; (4) structural and aeroelastic performance of the graphite composite fore/aft swept X-Wing wings; (5) the performance, design integration, and reliability aspects of the Convertible Fan/Shaft Engine and rotor drive system; (6) an operational speed/altitude envelope with speeds in excess of Mach 0.80 at 30,000 feet; (7) specific cruise ranges comparable to tactical fixed wing aircraft; low speed and hover control power and damping levels in excess of current helicopter experience; (8) and downwash environment evaluation.

Also at the start of Phase 1 a Convertible Fan/Shaft engine program was initiated jointly with NASA. The prime focus of this program is for the X-Wing vehicle although its very broad, generic, applicability to other advanced vehicles makes it a stand-alone program within DARPA and NASA. Applications include the Tilt Nacelle VTOL, the Folding Tilt Rotor concept and high speed 250 knot Thrust-Compounded Helicopters. The engine selected is the TF-34 which, with the addition of variable geometry, is capable of delivering in excess of 5000 shaft horsepower in the Shaft Mode and in excess of 8000 pounds thrust in the Fan Mode. The high technology and extremely low cost of this program (\$8 Million to design, modify, and conduct steady and dynamic tests with an advanced digital control system) represents a major potential breakthrough in VTOL propulsion systems. It is estimated that this engine could be completely developed and fielded for approximately 5 percent of the cost of a new VTOL engine.

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The two prime contractors will continue their activities through FY 1982 with a competitive selection for a flight article to be made in early FY 1983. A decision on the technical, operational and cost objectives for the competition will be reached during the third quarter of FY 1982 and specific guidance provided to the contractors. Discussions are currently proceeding with the Service technical and operational communities regarding the various demonstrator options. A broad based Military Utility Analysis of the X-Wing is also planned for completion in the third quarter FY 1982. Significant service involvement in the X-Wing program will have a strong influence on the demonstrator vehicle objectives.

3. Program to Completion: The end objective of this program is the flight test validation of two operational size vehicles configured around the Convertible Engine. The 'high option' under active consideration would consist of the design, fabrication, wind tunnel test and flight test during FY 1985/86 of a maximum performance airframe having the speed-altitude envelope, payload-range capability, handling qualities and folding features (for hangaring on small ships) of an operational aircraft. This airframe would be configured around the Convertible Fan/Shaft Engine currently underway. Costs for this option are in the \$200 Million range (including Convertible Engines) and would require substantial Service participation. The 'low option' would consist of an FY 1985 flight test of operational size rotor blades, hub and fly-by-wire controls on the existing Rotor Systems Research Aircraft (RSRA) over the low speed and conversion speed range. Following these tests an engineering development program of an airframe which utilizes the RSRA rotor assets and convertible Engine could then be undertaken with a higher probability of achieving a viable VTOL aircraft. Intermediate options being considered include the use of existing airframe components and engines for a technology demonstrator which could validate the conversion flight, speed-altitude envelope and handling qualities, but not the empty weight. Such a program would have a late FY 1985 flight date and would be in the \$125 million range. Evaluation of these options should be complete by the third quarter of FY 1982.

4. Milestones: As described above, following the very successful completion of the 25 foot rotor system wind tunnel tests in FY 1979, the entire X-Wing Program was restructured in mid FY 1980 by the Deputy Under Secretary of Defense Research and Engineering toward a larger vehicle. The restructured activity is currently well underway with revised milestones as indicated below. A strong competitive position suitable for a high confidence down-select should be attained by early FY 1983.

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Title: X-Wing
 Title: Experimental Evaluation of Major Innovative Technologies
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<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Early FY 1982	Complete subscale and 25 foot rotor whirl test data base expansion program.	Subscale tests completed; whirl test start delayed to time-phase with Phase 1 contracts.
Late FY 1982	Late FY 1982	Subsystem Design Review.	
--	Late FY 1982	Evaluation of flight vehicle designs and program options.	New Milestone.
--	Late FY 1982	Review of 0.20 scale Dynamic Model test data for readiness to proceed with flight program.	New Milestone.
--	Early FY 1983	Competitive selection of flight vehicle program.	New Milestone.
Late FY 1983	--	Fabricate wind tunnel test operational size rotor.	Rotor test now included in overall vehicle pre-flight test phase.
Late FY 1984	Early FY 1984	Flight demonstrator design review.	Program schedule changed to RSRA option.
Late FY 1985	Late FY 1985	Flight clearance review.	No change.

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Title: X-Wing
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5. Resources: (\$ in thousands). Current estimates beyond FY 1982 will remain tentative until mid FY 1982 when present Design Definition Activity yields data for program options to be selected and service participation can be determined. FY 1983 funding will initiate flight vehicle program in early FY 1983.

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
X-Wing	3,800	6,278	7,500	14,500

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-6

Program Element: #62711E

DoD Mission Area: 530

Title: Advanced Sensor Demonstration Program

Title: Experimental Evaluation of Major Innovative Technologies

Budget Activity: 1. Technology Base

F. DETAILED BACKGROUND AND DESCRIPTION: The success of the DARPA High Altitude Large Optics (HALO) program for development of advanced infrared surveillance sensor technology has led to the formulation of the Advanced Sensor Demonstration (ASD) Program. The principal thrust of this program is the fabrication and test of the a sensor which utilizes key elements of HALO technology to demonstrate advanced surveillance missions and provide the basic phenomenological data base for design of future systems. This sensor will demonstrate major improvements in sensitivity measurement precision and significant improvements in precision, thus maximizing the system flexibility and minimizing national vulnerability to changes in Soviet systems. The tracking of will facilitate test of surveillance concepts for defensive and offensive force management in space and SALT verification issues. Long observation time and high sensitivity with medium spatial resolution enable the detection and tracking of . This capability, in addition to the ability to observe will allow evaluation of the utility of space sensors in both . The on-board processor has the potential to enable users to utilize real-time data to demonstrate the functional support provided by a space asset and evaluate the advantages of a space sensor to a number of Service war fighting missions.

Detailed sensor definition is not yet finalized, but it is expected that the Mini-HALO sensor will require a telescope of somewhat less than aperture and a field-of-view, a focal plane with approximately detector elements operating in the spectral range, and an filter on part of the focal plane. The sensor will be supported by an on-board signal processor and cooled by an active cryogenic refrigerator.

The on-board processor supports and manages the focal plane. Signal encoding, overload sensing and control, temporal filtering, threshold detection, and target track formation are performed by the processor, resulting in a major reduction in data volume. For the experiment, data will be available on demand at each major node in the processing chain, but the data compression achieved by the processor will enable a demonstration of narrowband, survivable data links which pass only validated target tracks to small simplified ground stations. On-board event message generation will be examined as well to determine the utility of performing a full end-to-end data processing demonstration on-board within the cost constraints.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-6
Program Element: #62711E
DoD Mission Area: 530

Title: Advanced Sensor Demonstration Program
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- G. **RELATED ACTIVITIES:** This program is related to the USAF Advanced Warning Sensor (AWS) Program for Missile Early Warning. The USAF Space Division, in their role as AWS manager and DARPA agent for the Advanced Sensor Demonstration Program provides a logical technology transfer point. The technology base demonstrated supports surveillance sensors for
for attack assessment.
- H. **WORK PERFORMED BY:** This program will be 95% industrial and 5% Federal Contract Research Center (FCRC). Industrial contractors include: Hughes Aircraft Company, Culver City, California; C.S. Draper Laboratory, Cambridge, Massachusetts; and AiResearch Corporation, Torrance, California. FCRC support is obtained from the Aerospace Corporation, El Segundo, California.
- I. **PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. **FY 1981 and Prior Accomplishments:** Technology development to support the Mini-HALO sensor was carried out under the DARPA Space Surveillance and Advanced Optics Project (ST-2) in Program Element 62301E. Component developments were initiated and demonstrated under the HALO technology program for spectral filters, large lightweight cooled optics, detector arrays, adaptive signal processors, and high reliability cryo-refrigerators. The initiation of this flight experiment was made possible by achievement of major technology milestones in FY 1978 and FY 1979. Development of major system critical components was then initiated.

A contractor was selected late in FY 1979 to design and build the Integrated Spacecraft and Sensor and conduct the experiment. The single contractor approach was chosen to assure performance, reduce cost, risk, and testing time, and to reduce management interfaces. This will further be backed up by a contractual incentive for on-orbit performance.

A systems requirements review (SRR) in 1980 formalized a set of future surveillance mission requirements. During FY 1981 the program focus was a Preliminary System Design Review (PSDR) held to insure that the baseline system design was complete, consistent and supportive of the program's basic functional requirements. This effort resulted in preliminary top level system and interface specifications to be followed by a complete cost and schedule evaluation of the upcoming development phase.

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There was significant progress during FY 1981 in the development of major technology subsystems with the intermediate development milestones being achieved on schedule.

Prototype multiplexer arrays have been fabricated and evaluated with detector arrays at infrared wavelengths. Intermediate performance goals were exceeded and development proceeded on schedule to the demonstration. The spectral filter task continued with the principal effort focused on materials processes for fabricating a fifty layer longitudinal demonstration filter (LEOTF). A simulated IR target was used to spot illuminate a HgCdTe array. Data from the array was then routed to the signal processor breadboard for realtime signal processing. Breadboard processor software was then used to acquire the target, hand off the target from low resolution to high resolution tracking, predict the target track, and finally, to generate the track report at the signal processor output. This end-to-end functional demonstration provided the necessary confidence in compatibility and capability of these critical technologies.

The HALO signal processor task has been concentrating on the development of critical large scale integrated circuit components and proof-of-concept demonstrations of basic clutter filtering, target acquisition and tracking software functions. The processor hardware components consist of seven different custom chip types, a 16,000 bit random access memory (RAM) chip, and a microprocessor, combined in a flexible, modular architecture. Two custom chips have been fabricated and tested. The chips follow state-of-the-art commercial design rules but are fabricated using special radiation hardness processing, 2 micron line geometry, a six-transistor static cell design for high transient stability, and silicon-on-sapphire technology for low power consumption. Fully functional 16K RAM chips were successfully produced and these parts have withstood total doses greater than 10^5 Rads Silicon with virtually no change in operating characteristics.

2. FY 1982 Program and FY 1983 FY 1984 Planned Programs: Technology developments will continue during this phase with emphasis on demonstration of the technology goals needed to proceed to the critical subsystem and sensor preliminary design and system design reviews.

The detector/multiplexer development task is focused on completing the technical feasibility demonstration of large scale wide band detectors and multiplexers. Pre-prototype hybrid array fabrication will be completed and

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testing begun. In addition, production planning necessary for the manufacture of focal plane arrays in the subsequent program phases will be completed, including a demonstration of the close packaging aspects of the four-chip submodule design (multi-layer ceramic motherboard, over-the-edge electrical contacts, compact ribbon cables, etc.), and the design and fabrication of Large Scale Integrated Circuits (LSIC) chips for the command and control electronics.

The key objective in this phase of the filter technology task is the development of a reliable, well controlled process for the growth of filter materials. Intermediate objectives include fabrication and test of experimental filters (10 to 50 layer pairs) to demonstrate predicted performance and to refine both the analytical model and the detailed design. In parallel with the filter layer work, the development of associated high voltage cables and contacts, wire grid polarizers, wideband infrared coatings, and high voltage drivers will be pursued.

The objective of the processor development is to provide the design for a versatile, lightweight, radiation hard, on-board signal processor. The near term objectives are to expand the breadboard and to use it to develop the remaining proof-of-concept software and to evaluate several custom LSIC chips retrofitted into the breadboard. The LSIC chips are needed to meet the size, weight, power and radiation specifications of the eventual flight unit. In this period it is planned to complete the development of the prototype flight 16K RAM and perform radiation and reliability testing. Performance of the 16K RAM to the full flight specification will be demonstrated. The processor breadboard hardware will be expanded by adding an additional strategic filter to enhance it as a test bed to demonstrate key software functions such as handover of the low resolution tracker to the high resolution tracker.

The system development effort has two main thrusts in this phase, 1) to prepare the six-hour orbit configuration for a Preliminary System Design Review (PSDR) with fully developed program plan and firm cost data for the next phase, and 2) to initiate long-lead sensor design tasks so that downstream flight schedule options can be maintained.

The efforts involved in the long-lead sensor design tasks are: 1) develop the optics design in order to specify, select vendors, and order mirrors for the Engineering Development Model (EDM): 2) develop the telescope

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mechanical design for the EDM; 3) develop the stabilization and pointing system servo mechanical and electrical design in order to build and test a brassboard subsystem in preparation for a sensor PDR scheduled in the next phase.

3. Program to Completion: All key subsystems will be functionally integrated and tested in the engineering development model in FY 1986 in preparation for payload integration and testing in and spacecraft system testing in . The system will be delivered in for a launch. On orbit design life will be months with program completion, including on orbit operations, in .

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below;

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Early FY 1982	Begin Turborefrigerator endurance testing.	No change.
--	Late FY 1982	HgCdTe, LWIR demo chip.	No change.
Late FY 1982	Mid FY 1984	Payload preliminary Design Review.	Reduced FY 1982 and 1983 funding due to revised program priorities.
Late FY 1983	Early FY 1986	System Preliminary Design Review.	Reduced FY 1982 and 1983 funding due to revised program priorities.
Early FY 1984	Late FY 1985	Payload Critical Design Review.	Reduced FY 1982 and 1983 funding due to revised program priorities.

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Project: #EE-6
 Program Element: #62711E
 DoD Mission Area: 530

Title: Advanced Sensor Demonstration Program
 Title: Experimental Evaluation of Major Innovative Technologies
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
		Launch.	Reduced FY 1982 and 1983 funding due to revised program priorities.
		Program Completion.	Reduced FY 1982 and 1983 funding due to revised program priorities.

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Advanced Sensor Demonstration	14,307	23,245	50,100	68,500

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-7
Program Element: #62711E
DoD Mission Area: 530

Title: Acquisition, Tracking and Pointing Experiment - TALON GOLD
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: Talon Gold is an Acquisition, Tracking and Pointing (ATP) experiment designed to establish the feasibility of achieving ATP performance levels

of this type requires high performance ATP capabilities because of the stringent conditions which are complex products of ranges, engagement kinematics, targets of interest, and reaction times, as well as desired system accuracy and stability. The Talon Gold Program is intended to establish the feasibility of achieving the appropriate performance levels by developing and performing a space experiment. The selection of a space test approach was based on the necessity of evaluating the system in the appropriate environment, and obtaining the required test data in an unambiguous manner. As a consequence, the Talon Gold Experiment serves as a major milestone in the development of the requisite technologies, a means of obtaining subsystem and system performance data in a representative environment, and an opportunity to demonstrate the ATP capabilities

- G. RELATED ACTIVITIES: This project is closely related to the DARPA High Energy Laser (HEL) technology project (Program Element #62301E, Project #ST-3), and can be described as the major element in support of tracking and pointing technology aspects of that program. A close working interface exists between this program and the Military Departments Service High Energy Laser programs which deal with tracking and pointing technology. The principal Service agent for this program is the Air Force Space Division; other supporting agencies include the U. S. Army Missile Command.

The Air Force Space Test Program (PE 63402F) is responsible for providing the supporting pallet, pointer, and avionics, integrating the Talon Gold experiment with the pallet, and providing flight services. Current plans are to bail a spacelab pallet from NASA to be modified as appropriate for Talon Gold.

- H. WORK PERFORMED BY: This effort is performed by industrial contractors (93%) and by a federal contract research center (7%), Aerospace Corporation, El Segundo, California. Industrial contractors include: Lockheed Missiles and Space Company, Sunnyvale, California; Hughes Aircraft Corporation, Culver City, California; Charles Stark Draper Laboratories, Cambridge, Massachusetts; General Research Corporation, McLean, Virginia; and Science Applications Incorporated, Stuart, Florida.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-7
Program Element: #62711E
DoD Mission Area: 530

Title: Acquisition, Tracking and Pointing Experiment - TALON GOLD
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The program was initiated in FY 1979 with competitive concept definitions conducted by Lockheed and Rockwell. Both contractors evaluated the Acquisition, Tracking and Pointing (ATP) capabilities and performance levels required for a

The contractors then developed experimental designs which included an ATP system, to be launched as a space shuttle sortie, space and airborne targets, and a test plan. These concepts were presented at a Systems Design Review (SDR), held during the first quarter of FY 1980. The SDR considered both the suggested experimental test program and the system design approaches proposed to achieve the required substantial increase in acquisition range and the order of magnitude improvement in pointing and tracking performance. Based on the SDR, both Lockheed and Rockwell were awarded contract extensions to develop preliminary designs of their respective concepts and to conduct brassboard tests of critical items. The brassboard activities were designed to provide data required for the design of the flight hardware and to reduce the program risk to an acceptable level. During FY 1980 the brassboard designs were completed and fabrication and test activities were initiated. Preliminary data obtained as part of these initial tests indicate that the stabilization and alignment requirements, which represent an improvement in the state-of-the-art, can be met.

During FY 1981, the contractors developed designs of the flight hardware in preparation for a Preliminary Design Review (PDR), held during the third quarter of FY 1981. The preliminary designs were supported by tests and evaluations of critical components and subsystems for which brassboards were developed. The brassboards were used to select between alternate design approaches, and to provide data required for the definitization of the flight hardware designs, thereby reducing the risk of the succeeding program phases. The brassboard development and test activities addressed high risk areas including pointer-tracker boresight and alignment, inertial stabilization, infrared sensors for acquisition and tracking, active tracking, and space qualification of critical components.

The competitive phase of the program continued through the end of FY 1981. A source selection evaluation was conducted based on the Preliminary Design Review, supporting brassboard test data, and the contractors' proposals for the succeeding program phases.

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Budget Activity: 1. Technology Base

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In FY 1982 the source selection process is being concluded with the selection of the Phase II contractor and definitized contract negotiations during the first quarter. The detailed design activities will then be initiated including the development and definitization of the system specifications, prime item development specifications, computer program development specifications, fabrication drawings for flight and test hardware, fabrication procedures and space qualification/acceptance plans. Data on the space shuttle environment obtained during initial flight tests will be incorporated into the design. Additional brassboard tests will be defined and conducted where indicated by the Preliminary Design Review evaluations, shuttle flight experience or where substantive design changes are identified during the detail design process. The use of solar illuminated visible techniques for acquisition will be investigated. While IR acquisition is directly traceable to operational system requirements and its implementation would provide for evaluation of the requisite technologies, the visible technique will provide a lower cost acquisition approach for the Talon Gold experiment.

Primary emphasis during FY 1982 will be on defining interface requirements between the Talon Gold experiment and supporting spacelab hardware and NASA/AF communications organizations. These activities will culminate in an Interface Specification Review (ISR) at the end of FY 1982.

A total program Interim Design Review (IDR) will be held in the second quarter of FY 1983. At this time the experiment content will be definitized. Detailed design will be approximately 40% complete. Only the visible acquisition approach will be carried past IDR. Inclusion of IR acquisition in the Talon Gold experiment requires enhanced funding levels.

The detail design process initiated in FY 1982 will culminate in a Critical Design Review (CDR) conducted during the fourth quarter of FY 1984. The CDR will examine the hardware designs, supportive analyses, fabrication process specifications, space qualification/acceptance plans, and software specifications. Fabrication of the hardware components and assembly of these components into first level subsystems will be initiated after approval of the CDR. Coding of the required system software and firmware will be initiated.

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Project: #EE-7
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 DoD Mission Area: 530

Title: Acquisition, Tracking and Pointing Experiment - TALON GOLD
 Title: Experimental Evaluation of Major Innovative Technologies
 Budget Activity: 1. Technology Base

3. Program to Completion: Fabrication and assembly of the components and subsystems will be initiated in FY 1985, based on the approved design. Additional tests and analyses will be performed, as required, based on the recommendations of the Design Review Board.

The development of the flight hardware will continue in FY 1986 through the completion of the fabrication, assembly, space qualification and acceptance test of the subsystems and full experiment payload. Alignment, calibration and preflight performance tests of the payload will be conducted as part of the final acceptance tests. The preflight tests will evaluate the system performance within the limits imposed by the ground test environment. The Acquisition, Tracking and Pointing payload will then be delivered to the integrating contractor.

The first test flight is scheduled for with a second flight in . The results of these tests will be analyzed to establish the design requirements and approaches appropriate for future systems, and to assess the potential performance of operational systems.

4. Milestones:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
early FY 1982	late FY 1982	Ground-Based Brassboard testing.	Possible requirement for additional tests to reduce risk.
--	mid FY 1983	Interim Design Review. (IDR).	New Milestone.
mid FY 1983	late FY 1984	Critical Design Review (CDR).	Expanded schedule due to contractor schedule risk predictions and desire to incorporate brassboard data into designs.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-7
 Program Element: #62711E
 DoD Mission Area: 530

Title: Acquisition, Tracking and Pointing Experiment - TALON GOLD
 Title: Experimental Evaluation of Major Innovative Technologies
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
mid FY 1985	late FY 1986	Delivery of Experiment Hardware to Integrator.	Accommodates new CDR Schedule and funding requirements.
		Launch and Space Test.	Accommodates new CDR Schedule.

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Acquisition, Tracking and Pointing Experiment - Talon Gold	17,130	25,800	35,000	58,400

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-8
Program Element: #62711E
DoD Mission Area: 530

Title: High Power Chemical Laser Ground-Based Experiment - ALPHA
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The overall thrust of the High Power Chemical Laser Technology is the resolution of the critical chemical laser device technology issues required for the development of a
One goal is establishing the feasibility of a
Emphasis in this effort is placed on the ground-based test and evaluation of a
This ground demonstration is entitled Project ALPHA. The far-term goal is the development of the technology for
The focus for this effort is development of advanced optical resonator concepts for very high power devices. The objective of Project ALPHA is to develop the technology for, and to demonstrate the feasibility of, extracting a
- G. RELATED ACTIVITIES: The fundamental laser technology efforts supporting this project are developed in the High Power Chemical Laser Development portion of the DARPA High Energy Laser Technology Program (Program Element #62301E, Project #ST-3). Coordination with the Military Department's high energy laser activities and the DARPA program is maintained through reviews with the Director, Directed Energy Technology, Office of the Under Secretary of Defense for Research and Engineering. The primary agent for this program is the Air Force Weapons Laboratory, Kirtland Air Force Base, Albuquerque, New Mexico, with supporting agent at the U.S. Army Missile Command, Huntsville, Alabama.
- H. WORK PERFORMED BY: This project is performed 100% by industrial contractors. They are: General Research Corporation, McLean, Virginia; Rockwell International, Rocketdyne Division, Canoga Park, California; TRW, Inc., Los Angeles, California; R&D Associates, Albuquerque, New Mexico; W. J. Schafer Associates, Arlington, Virginia; and Science Applications, Inc., Atlanta, Georgia.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:
1. FY 1981 and Prior Accomplishments: The ALPHA Project was initiated in FY 1978 with the test and evaluation of nozzle technology scaling modules. These tests with modules of established the validity of scaling nozzle performance data hardware to large-scale laser devices. These tests also confirmed

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Title: High Power Chemical Laser Ground-Based Experiment - ALPHA
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the feasibility of achieving high fuel efficiency high-power chemical lasers, and provided the critical nozzle performance data needed to initiate the preliminary design of a ground-based device in early FY 1980. Conceptual design contracts were initiated with three major contractors. These efforts addressed the design requirements for a chemical laser weapon system within the operational constraints of overall system In this way, they established the framework within which the ground-based demonstration was structured to unambiguously establish the technology for a These conceptual designs addressed the technical issues associated with nozzle and optical resonator design, optical bench and alignment system requirements, and reactant supply system and pumping facility requirements, as well as the cost and schedule to achieve the goals of the program. These conceptual designs were successfully concluded in mid FY 1980, at which time two of the three contractors were selected to proceed to preliminary design of the ground-based demonstration laser. These parallel efforts defined the performance requirements for the gain generator, optical resonator, and exhaust manifold assemblies for the chemical laser from which, the layout and engineering designs were generated. The design specifications included lightweighting of the gain generator and the optical resonator assemblies to the extent required to demonstrate the feasibility of incorporating specifications on a high energy chemical laser system. To support the designs, risk-reduction and design verification experiments were defined for the gain generator and the optical resonators, and fabrication of the test hardware was initiated. The design included planning for eventual laser testing, and cost and schedule analyses for fabrication and testing of the laser. It also included detailed analyses to provide traceability from the design features of the ALPHA I ground-based system to the ALPHA II chemical laser concept. The preliminary design studies were completed at the end of FY 1981. The engineering drawings for the laser, with their supporting analyses, were completed for the gain generator, optical resonator and exhaust manifold assemblies. Hardware design verification and risk reduction experiments have also been completed. These tests addressed the critical issues in gain generator nozzle fuel efficiency and in optical resonator performance. Through their design analyses, both contractors identified second annular resonator configurations which have the potential for scaling to laser powers of levels heretofore thought unattainable for near diffraction limited chemical lasers. The fundamental performance characteristics were verified by testing on laser testbeds at each contractor site. In addition, each contractor incorporated simplified nozzle concepts in their gain generator designs to reduce weight and to improve fabricability. The fuel efficiency of these concepts was verified by risk reduction experiments. Within

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Title: High Power Chemical Laser Ground-Based Experiment - ALPHA
Title: Experimental Evaluation of Major Innovative Technologies
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the design analyses, cost and schedule estimates were updated for the fabrication and testing of the ALPHA I laser. These efforts concluded with a Preliminary Design Review in the fourth quarter of FY 1981. Following an extensive evaluation of both Contractors' preliminary designs the Government selected a single contractor to proceed to detailed design, fabrication, and system level testing.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The detailed design of the gain generator, optical resonator, and exhaust manifold assembly are underway and are scheduled for completion in mid FY 1983. At that time the final design specifications and the final design analyses will be complete. This will include the completion of the bill of material, the cost/risk trade analysis, the make/buy plan and updated cost estimates. Long lead materials will be purchased and any high risk hardware fabrication processes will be started.

In addition, the contractor will complete the preliminary design of the test facility element in early FY 1983 and the detailed design in late FY 1983. The facility hardware includes the reactant storage, reactant feed, mounting and support, optical diagnostics, instrumentation and control, and the handling and refurbishment assemblies. In late FY 1983 DARPA will initiate the fabrication of the ALPHA laser and the facility hardware. Surrogate mirror fabrication will be performed to validate the processes associated with heat exchanger fabrication, plating, precision diamond turning, optical coating and measurement.

3. Program to Completion: Fabrication of the laser device and facility hardware will be completed early in at which time system integration will begin. After assembly and integration, ground testing of the laser will be initiated. Approximately eight months is required for thorough testing of the integrated gain generator and optical resonator. These tests will fully establish the feasibility of producing near diffraction limited beam performance for high-power chemical lasers appropriate for

4. Milestones:

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Project: #EE-8
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Title: High Power Chemical Laser Ground-Based Experiment - ALPHA
 Title: Experimental Evaluation of Major Innovative Technologies
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Mid FY 1983	Complete detailed design of laser subsystems; initiate fabrication.	Laser design stretched out to accommodate funding limitations.
Late FY 1982	Early FY 1983	Complete preliminary design of facility subsystems.	Facility design stretched out to remain within funding limitations.
Mid FY 1983	Late FY 1983	Complete detailed design of facility subsystems; initiate fabrication.	As above.
		Complete laser and facility fabrication.	As above.
		Complete High Power Testing Demonstration with High Fuel Efficiency.	Alpha I program stretched out to accommodate funding constraints.

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
High Power Chemical Laser Ground-Based Experiment - ALPHA	17,001	20,500	21,800	31,700

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-9
Program Element: #62711E
DoD Mission Area: 530

Title: Forward Swept Wing
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

F. DETAILED BACKGROUND AND DESCRIPTION: The Forward Swept Wing (FSW) program has the potential of achieving major technical breakthroughs in air vehicle design which can be translated into significant operational performance improvements. Breakthroughs are anticipated in the areas of structures, aerodynamics, stability and control, and configurational design freedom. Composite structure is used to solve the aeroelastic divergence phenomenon, a static structural instability experienced by forward but not aft swept wings. Advanced composite wing skins can be designed and fabricated to solve the problem without the weight penalty. The ability to design and build such a wing has been conclusively demonstrated in this program through large scale wind tunnel testing of two different designs. The aerodynamics of the forward swept wing design and the favorable interaction of the canard and wing provide greater useful lift at given angles of attack and allow higher angles of attack to be achieved before wing stall. As a result, significantly lower take off and landing speeds and much greater high angle of attack maneuverability are possible. This configuration also experiences lower drag due to lift during maneuvering flight. The vehicle, designed to be statically unstable, is easily controlled with the canard and has low subsonic and supersonic trim drag. Considerable design freedom and flexibility is possible because of the favorable position of aircraft center of gravity relative to the aerodynamic center of lift. Weight and/or volume can be varied significantly without serious controllability impact. The flight control system is digital fly-by-wire. Though not the first such system, it will be the first used to control such an unstable manned aircraft and will provide confidence to designers of future systems. These technical achievements are important when considered individually, but when combined in this flight vehicle, they synergistically produce considerable operational performance improvements. Analysis indicates that a FSW tactical aircraft could be as much as 30% lighter than an equivalent aft swept wing aircraft. This weight reduction can be translated into equivalent range/payload performance improvements. Any reduction in weight can also be translated into a cost saving. In addition, the competing designs for this program were point designed for high transonic maneuverability yet had impressive STOL capabilities even without sophisticated high lift devices. Such capabilities are due to the excellent low speed stability and control characteristics inherent in the FSW design. These performance improvements would be valuable to an Air Force advanced tactical fighter where runway denial is an operational concern or to the Navy for operations from small ships.

G. RELATED ACTIVITIES: The Flight Dynamics Laboratory (AFWL/F1) has been conducting research in the use of advanced composite materials for aeroelastic tailoring of aft swept wings since the early seventies. The computer

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Project: #EE-9
Program Element: #62711E
DoD Mission Area: 530

Title: Forward Swept Wing
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

techniques developed under this effort are directly applicable to the FSW program. In addition, the aerodynamic and structural techniques developed under NASA/Air Force high maneuverability aircraft technology program (HIMAT) have also been used for FSW analysis. The advanced digital flight control design and implementation efforts by the Air Force, the Navy, NASA and within industry are being tested and extended in this program. A DARPA/NASA Memorandum of Agreement has been signed for NASA Dryden to conduct the flight test phase of FSW program. Also, NASA Langley is conducting high angle of attack and spin wind tunnel testing to determine the aerodynamic coefficients and stability derivatives to use in NASA flight simulations of the planned flight vehicles. A DARPA/AFSC Memorandum of Agreement has been signed for AFWAL/FI to continue as the DARPA Agent.

- H. **WORK PERFORMED BY:** Approximately 95% of the effort is performed by industry. The principle contractors are: Grumman Aircraft Corporation, Bethpage, New York; the SRI Corporation, Menlo Park, California; and the Analytic Sciences Corporation (TASC), Reading, Massachusetts. Approximately 5% is being performed by NASA Centers/Langley and Ames with the Ames percentage increasing to a much larger amount as the flight test phase approaches. The technical agent responsible for program oversight is the Air Force Wright Aeronautical Laboratories, Flight Dynamics Laboratory (AFWAL/FI), to be assisted by NASA Dryden Flight Research Center.

I. **PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**

1. **FY 1981 and Prior Accomplishments:** The Forward Swept Wing (FSW) program has successfully completed the conceptual preliminary design and final design phases. Prior to FY 1980, the program concentrated on analysis and wind tunnel testing of FSW designs to determine the feasibility and potential benefits of this unique configuration. The low speed handling qualities and short take off and landing (STOL) capabilities, attributed to the configuration for years, were investigated and shown to be possible. Unexpected design flexibility was experienced because of the favorable relative positions of the center of gravity and center of lift and the aft placement of the wing box through the fuselage. Using the canard as both a lifting and trimming surface increased aerodynamic efficiency as a result of improved lift characteristics and reduced drag levels. In addition, the use of composite structure produced weight and cost savings. These structural, aerodynamic and design benefits were shown to be available if the composite structure and flight control system could be built. Large scale aeroelastically tailored composite wings were designed, fabricated and tested, and successfully demonstrated the

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Title: Forward Swept Wing
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

ability to solve the aerodynamic structural divergence problem. During FY 1980 the successful analysis, design and test of a flight control system with a man-in-the-loop simulation satisfied the remaining concerns. Three contractors offered proposals for the detailed design and fabrication of demonstration vehicles to be flight tested in late FY 1983. The program was reviewed in 1979 and 1980 by a blue ribbon panel of experts to evaluate, guide and focus the technical investigation. Twice the potential benefits were recognized and twice flight demonstration of the concept was recommended. It was felt that flight test would quantify the impressive benefits and more quickly mature and develop confidence in the technologies so that they might be exploited in future weapons systems sooner with less risk and at lower cost. In early FY 1981 three proposals for the final design, fabrication and functional flight testing of the demonstration vehicles were evaluated and Grumman Aerospace Corporation was selected to complete the program. By the end of FY 1981 the final design of the vehicle was 80% complete, an instrumentation package was designed which insured flight safety and correlation of test results with design goals and objectives, long lead fabrication items were ordered and the design and evaluation of the flight control laws continued. NASA high angle of attack wind tunnel results were correlated with earlier work and wind tunnel spin testing continued. The Air Force formed an Advanced Development Program Office to act as the DARPA agent and NASA contributed significant engineering manpower support during the evaluation and subsequent program formulation. The Forward Swept Wing advanced technology demonstration has been designated the X-29A experimental aircraft.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In the FY 1982 planned program, final drawing release will initiate tooling fabrication and a decision will be made as to whether one or two aircraft will be procured. NASA wind tunnel testing will be completed on the Grumman inlet design and three months of final configuration documentation will also be completed in the NASA wind tunnels. The resulting non-linear aerodynamic data package will be integrated into the six degree of freedom man-in-the-loop simulation to investigate flight characteristics and to tailor the aircraft handling qualities. Prototypes of the actual flight control computers will be used in this simulation to validate both hardware and software designs. The instrumentation package will be finalized. The simulation at NASA Dryden, intended to support the government flight tests, will be constructed. The flight test phase will be planned with a strong emphasis on developing an audit trail to link flight test results with the conceptual design, analysis and ground testing. Continuous AF/NASA interaction is planned.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-9
Program Element: #62711E
DoD Mission Area: 530

Title: Forward Swept Wing
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

In the FY 1983 planned program, fabrication will be completed and the vehicles will be prepared for the contractors functional flight tests and the follow-on government testing. All systems will be ground tested, the instrumentation will be calibrated and structural proof and load tests will be completed to prepare for flight tests. Engineering and flight safety reviews will be conducted to clear the vehicles for first flight.

In the FY 1984 planned program, functional flight tests will be completed by the contractor, the vehicles will be delivered to NASA Dryden and government flight testing will begin. A nominal flight envelope will be cleared to gain experience with the systems and then the structural divergence envelope will be investigated followed by low speed testing. NASA will conduct the flight tests and will be supported by the Air Force Program Office.

3. Program to Completion: Flight testing will be completed in FY 1985. The X-29A aircraft will then be assigned to a flight research organization for additional testing or be modified to investigate other concepts or technologies. A major effort will be conducted to transfer the flight test information as it is generated. This is a long range estimate based on success of meeting expected technical and management milestones.

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Early FY 1982	Complete detail design of flight vehicle.	Delayed selection and procurement.
--	Mid FY 1982	Wind tunnel documentation testing complete.	New milestone.
Early FY 1983	Mid FY 1983	Complete fabrication of flight vehicle.	Follows from previous milestone change.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-9
 Program Element: #62711E
 DoD Mission Area: 530

Title: Forward Swept Wing
 Title: Experimental Evaluation of Major Innovative Technologies
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	Early FY 1984	First flight of X-29A.	New milestone
Early FY 1984	Mid FY 1985	Complete flight tests.	Follows from previous milestone changes and rescope of Flight Test Phase.

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Forward Swept Wing	7,129	24,000	37,000	23,000

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-10
Program Element: #62711E
DoD Mission Area: 530

Title: Assault Breaker
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: Soviet doctrine stresses the offensive and calls for a concentration of forces to generate a breakthrough and then sustain the momentum of attack along major axes of advance.

The Assault Breaker program is developing and demonstrating the technologies required to deny the Warsaw Pact its second echelon exploitation and reserve forces with a capability for standoff acquisition and destruction of armored formations at ranges as great as beyond the Forward Edge of the Battle Area (FEBA), engaging and destroying the

The system includes Assault Breaker missiles and associated Pave Mover radars. The long range, airborne radar provides the capability for standoff surveillance to find and track targets and guidance for standoff missile attack or penetrating aircraft direct attack of the targets. The missiles and their munition dispensers provide the capability for delivering terminally guided submissiles to a high degree of accuracy (circular error probability of and achieve a high kill probability. The program has competitively developed the radar and weapon systems elements and is demonstrating them to provide the basis for full-scale development decisions by the Army for the Corps Support Weapons System and the Air Force for the Pave Mover radar.

- G. RELATED ACTIVITIES: Responsibility for managing the Assault Breaker program was assigned to DARPA by the Congress in FY 1978, bringing together service efforts in the development of terminally homing submunitions and low probability of the intercept airborne radars. The program is jointly funded by the Army, Air Force and DARPA under the overall direction of a Steering Committee composed of senior representatives of the three agencies and the review of an Executive Committee composed of the Under Secretary of Defense for Research and Engineering and the Army and Air Force Assistant Secretaries for Research and Development. The ground launched missile phase of the program is managed by the Army's Missile Command (MICOM) and the development of the radars and the air launched demonstration phase by the Electronic Systems Division, Air Force Systems Command.
- H. WORK PERFORMED BY: 90% of the program is contracted to industry including Martin Marietta Corporation, Orlando, Florida; Vought Aerospace Corporation, Dallas, Texas; Boeing Corporation, Wichita, Kansas; Hughes Aircraft Company, Culver City, California; Grumman Aerospace Corporation, Bethpage, New York; General Dynamics Corporation,

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-10
Program Element: #62711E
DoD Mission Area: 530

Title: Assault Breaker
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

Pomona, California; and AVCO International, Wilmington, Massachusetts. The remaining 10% covers in-house costs and test support at U.S. Army Missile Command, Huntsville, Alabama; Air Force Rome Air Development Center, Griffiss Air Force Base, New York; Air Force Armaments Division, Eglin Air Force Base, Florida; Air Force Electronics Systems Division, Hanscom Air Force Base, Massachusetts; and White Sands Missile Range, New Mexico.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The Assault Breaker program began in FY 1978 with the objective of developing and demonstrating the technologies for standoff acquisition and destruction of stationary and moving targets in the Warsaw Pact second echelon at ranges as great as beyond the Forward Edge of the Battle Area. From FY 1978 through the first quarter, FY 1981, initial component technologies were developed and demonstrated for the Pave Mover radar, T-16 PATRIOT ground launched missile and munitions dispensers, and terminally guided submissiles and submunitions. In FY 1979 tests for the munition dispensers at supersonic and high subsonic speeds proved the feasibility of stably, dispensing munitions in the flight regime of the missile. Development of munitions dispenser for a ground launched version of the T-22 Lance missile and a solid fuel Lance II missile began in FY 1980. Captive flight and tower tests demonstrated the feasibility of the submunitions to acquire, home and impact on targets in FY 1979 and were followed in FY 1980 by free fall flight test of the Infrared (IR) Terminally Guided Submunitions (TGSM) by two competing contractors. Free fall flight test of TGSM using millimeter wave radar seekers were not successful and that effort was terminated in late FY 1980. Successful completion of the IR TGSM drop test coupled with that of the munition dispenser represented a major milestone in preparation for the flight demonstration in FY 1981. A second smart bomblet submunition for use against soft targets, and also possessing a capability for top attack of armored targets, was successfully tested in February 1980 and selected for the flight demonstration.

In FY 1981, the ground launched version of the Assault Breaker weapon system concept was demonstrated at White Sands Missile Range. The two competing Pave Mover radars have been integrated in F-111 aircraft, and both are continuing to undergo surveillance and target tracking tests in FY 1982. These tests qualify the Pave Mover to be tested with the Assault Breaker Missile. The munition dispenser for the T-22 Lance II missile has successfully completed its qualification tests. Both the infrared terminally guided submissile and the smart bomblet

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-10
Program Element: #62711E
DoD Mission Area: 530

Title: Assault Breaker
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

submunition have completed full-function qualification test at White Sands and Sandia Laboratories, New Mexico, to qualify them for the flight test program. The ground launched Assault Breaker demonstration at White Sands is being conducted as a comparative evaluation of the T-16 PATRIOT and T-22 Lance II ground launched missiles. Two missiles of each type were fired during FY 1981. They were fired to verify basic missile accuracy, to demonstrate the capability of their dispensers to distribute dummy submunitions and to measure the ballistic accuracy achieved. Airborne integration of the Pave Mover radars was initiated during the third quarter of FY 1981. The guidance and small area moving target track modes were integrated and evaluation of those modes was started during the first quarter of FY 1982.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The ground launched Assault Breaker system demonstration will be completed during the second quarter of FY 1982 and the program will transition to the Army. Scheduled surface to surface firings evaluate the ability of the missile to dispense live submunitions and the ability of the submunitions to achieve a "kill" on stationary tank targets. During these flights the Pave Mover radar capability for tracking targets and the in-flight missile is also being evaluated. In the final shot(s) for the surface to surface program the entire system is being evaluated against moving targets: the ability of the radars to acquire and track a moving target and provide guidance to the missile; the ability of the missile to guide accurately to the moving target and dispense its load of submunitions; and the ability of the submunitions to achieve multiple "kills" in the target.

In order to demonstrate fully the weapon delivery options of the Assault Breaker concept, a joint test (DARPA and Air Force) of an air launched version of the stand off missile will be conducted beginning in second quarter FY 1982. The test will consist of approximately six launches of the Assault Breaker missile from a manned aircraft. Army T-16 missiles are being modified for air launch for a B-52 aircraft, and analysis and wind tunnel tests are being conducted to demonstrate safe separation of the missile from the aircraft. Captive carry test of the missile in the aircraft are scheduled in late FY 1982. The Pave Mover radar will provide target acquisition and guide the missile to target engagement. Submunition dispensing and terminal effectiveness will also be demonstrated during these tests. The air launched phase of the Assault Breaker and the Pave Mover program will be transferred to the Air Force in late FY 1982 for further development of the Pave Mover system.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-10
 Program Element: #62711E
 DoD Mission Area: 530

Title: Assault Breaker
 Title: Experimental Evaluation of Major Innovative Technologies
 Budget Activity: 1. Technology Base

3. Program to Completion: No effort planned beyond end FY 1982.

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Early FY 1982	Mid FY 1982	Transition Weapon program.	No significant change.
Early FY 1982	Mid FY 1982	Initiate air launched weapon demonstration.	No significant change.
Late FY 1982	Late FY 1982	Transition radar air launched weapon programs.	No change.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Assault Breaker	69,179	21,469	--	--

This project is jointly funded with the Army and the Air Force.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-12
Program Element #62711E
DoD Mission Area: 530

Title: Large Optics Demonstration Experiment - LODE
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: The Large Optics Demonstration Experiment (LODE) will demonstrate critical beam control and optics technology in a series of ground-based experiments that simulate the space environment. LODE is one of the "TRIAD" of DARPA laser programs that will collectively demonstrate the key technologies essential for . These technology developments initially targeted at supporting relatively near term system concepts , will in large part provide technologies scalable to even more capable . This program builds on previous accomplishments by the Air Force and Navy in High Energy Laser (HEL) beam control, but extends the technology significantly to larger size, higher performance levels, . Specific program objectives include demonstration of the ability to manufacture a large aperture mirror that includes complex interactive control systems, and energy management in an overall beam control system that yields better than wave optical quality and is consistent with pointing accuracy in a simulated operational environment. The actual demonstration will be conducted in ground-based facilities using low power laser and simulator techniques to establish with high confidence the required beam control performance. The advances contemplated in this program will, high-energy laser systems possible.
- G. RELATED ACTIVITIES: This project is closely related to two other members of the "Triad" technology demonstration programs (both in Program Element #62711E): "Acquisition, Tracking and Pointing Experiment" - Talon Gold (Project #EE-7) and "High Power Chemical Laser Ground-Based Experiment" -Alpha (Project #EE-8). Furthermore, the DARPA High Energy Laser (HEL) Technology Program Element #62301E, Project #ST-3, provides the fundamental optics technology efforts required to support the advanced component requirements of this program. A close working relationship exists between this program and the Military Departments HEL programs addressing laser beam control technology. The principal Service agent for this program is the Air Force Weapons Laboratory with major participation by the Rome Air Development Center in certain optics technology efforts. The Air Force Space Division, the Army Ballistic Missile Defense Advanced Technology Center, and the Navy HEL Program Office are also doing related work.
- H. WORK PERFORMED BY: Effort is performed primarily by industrial contractors (94 percent). Included are: Hughes Aircraft Company, Culver City, California; Lockheed Missiles and Space Company, Palo Alto, California;

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-12
Program Element #62711E
DoD Mission Area: 530

Title: Large Optics Demonstration Experiment - LODE
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

Corning Glass Works, Corning, New York; Perkin-Elmer Corporation, Danbury, Connecticut; Itek Corporation, Lexington, Massachusetts; Eastman Kodak Corporation, Rochester, New York; W. J. Schafer Associates, Wakefield, Massachusetts; and MRJ Inc., Arlington, Virginia. The University of Arizona, Tucson, Arizona; the University of New Mexico, Albuquerque, New Mexico; and the Massachusetts Institute of Technology (Lincoln Laboratory), Lexington, Massachusetts, participate to the extent of about four percent. The remaining effort, about two percent, is performed by the Service agents as in-house effort, involving the Air Force Weapons Laboratory, Kirtland AFB, New Mexico; the Rome Air Development Center, Griffiss AFB, New York; and the Naval Weapons Center, China Lake, California.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: This program was begun in FY 1980. Prior to the program start, various technology studies in large optics, adaptive optics, structural/optical modeling, water cooled optics, etc., were conducted under the Laser Optics technology base program. Results of this program formed the basis for initiation of the LODE program. In FY 1980, a major purchase of ULE glass was made as a long lead investment for the LODE primary mirror. Several studies of competing concepts for LODE primary mirrors were completed and 45 variations were screened. The major types -- passive monoliths, continuous faceplate active mirrors, and segmented mirrors were investigated in numerous manifestations. Additional small technology programs were initiated in optical fabrication processes, optical gratings, and non-linear adaptive optics. Finally, competing conceptual design studies for the LODE demonstration were initiated late in the year.

The FY 1981 program continued major efforts in the conceptual design of the LODE demonstration and the initiation of the design program for primary mirrors. A decision was made to develop a full scale primary mirror with the intent to fully develop and manufacture this mirror, then test its operation in the LODE equipment. This effort will continue to advance the technology of the concepts that have real growth potential for diameters beyond and will yield information on how the mirror design will impact beam control and beam expander system designs. The conceptual design study for LODE has achieved major milestone objectives in completing the definition of system flowdown requirements, mirror requirements and an initial design review on the LODE experiment. In FY 1981 additional technology programs were

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-12
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DoD Mission Area: 530

Title: Large Optics Demonstration Experiment - LODE
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

initiated in the areas of large mirror technology, including studies of using Zerodur glass in place of ULE glass and of making large thin glass facesheets by fusing smaller pieces together. Several studies initiated in FY 1980 have been completed. The "Fast Fine Grind" study of a new method of using diamond grinding components imbedded in a hard lap has produced excellent results that promise to save many months in the optical fabrication of large mirrors.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Early in FY 1982 the conceptual design of the Large Optics Demonstration Experiment (LODE) will be completed. This will determine the future scope of the program based upon both technical requirements and available resources. Tradeoffs of such beam control features as wavefront control (adaptive optics), large beam expander structures, infrared autoalignment, and laser interfaces will be accomplished. These design efforts will also define required technology risk reduction and breadboarding programs for execution during the final design phase. After concept definition a single contractor source will be selected and the detailed design of LODE will be initiated. Simultaneously, detailed design of the LODE primary mirror will be underway with completion of the Preliminary Design Review (PDR) planned by mid-FY 1983. These mirror activities will include limited breadboard activities on controls, actuators, sensors, and fabrication methods. The engineering design will establish final specifications and interfaces, manufacturing methods, and metrology techniques. Final production of the ULE glass needed to manufacture the mirror will be completed. During this year an independent analysis will be conducted to support selection of the appropriate subsystems, breadboard experiments, simulations and component hardware tests which could most cost-effectively reduce program risk.

The major FY 1983 event will be the completion of the preliminary design of the LODE experiment and risk reduction breadboard activities at the component or subsystem level. The preliminary design of test and simulation facilities will also be completed. A late-year Preliminary Design Review (PDR) will allow a detailed screening for the engineering concepts proposed and thorough analysis of system trades. For the mirror, the brassboard subscale mirror will be used to validate the various fabrication techniques for the full-scale mirror. The order for the ULE for the mirror will be placed, fabrication of other mirror components initiated, and the development of facilities for optical fabrication (girding, polishing, metrology, etc.) will be underway.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-12
Program Element #62711E
DoD Mission Area: 530

Title: Large Optics Demonstration Experiment - LODE
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

Activities in FY 1984 will culminate in a Critical Design Review (CDR) of LODE supported by completion of the supporting hardware risk reduction efforts. The fabrication of the mirror will be well underway. All facilities and metrology equipment necessary to support the mirror fabrication will be completed and in use.

3. Program to Completion: The development of a beam control system technology for large aperture space laser weapons will continue with the fabrication, acceptance test, and subsystem integration of the Large Optics Demonstration Experiment (LODE) hardware and its supporting simulation and test facilities. The complete LODE hardware will be delivered in and integration activities (including test facilities and simulation) will be initiated. The mirror will be delivered in and integrated with the LODE hardware. Finally, following successful integration, the program will culminate with the extensive ground testing of the LODE hardware through . The results of these sophisticated test programs will be analyzed and the impact of the demonstration upon future space laser weapons system capabilities will be assessed.

4. Milestones: The milestones cited in the FY 1982 Descriptive Summaries with completion dates through Mid FY 1982 have been completed and are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Early FY 1982	Complete LODE concept definition.	Reduced Funding Profile and Technical changes.
--	Late FY 1983	LODE Preliminary Design Review (PDR).	New Milestone.
--	Early 1984	Deliver active mirror subscale breadboard.	New Milestone.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-12
Program Element #62711E
DoD Mission Area: 530

Title: Large Optics Demonstration Experiment - LODE
Title: Experimental Evaluation of Major Innovative Technologies
Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1981	Mid FY 1984	Complete mirror design, initiate fabrication.	Change in Program Scope.
Late FY 1982	Late FY 1984	LODE Critical Design Review (CDR).	Change in Program Scope.
Mid FY 1984	Mid FY 1984		No change.
		LODE hardware delivery.	Reduced Funding Profile.
	Deleted	surrogate mirror delivered.	Requirement deleted.
	Deleted	Large Optics Demonstration Experiment integration with surrogate mirror and tests complete.	Activity deleted from program.
		Deliver primary mirror and integrate in LODE.	Reduced funding profile.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Large Optics Demonstration Experiment (LODE)	6,774	15,200	14,200	22,200

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-15
Program Element: #62711E
DoD Mission Area: 530

Title: Project SORAK (Korean Equipment Upgrade)
Title: Experimental Evaluation of Major Innovative Techniques
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: A North Korean (NK) Aggression against the Republic of Korea (ROK) will probably feature three main elements:

it is imperative that the early warning and surveillance capabilities of the Combined Forces Command -Korea (CFC-K) be highly effective and efficient. The major thrust of Project SORAK is to demonstrate a near-real-time intelligence, an early warning and targeting system based upon multiple sensor platform inputs, a survivable communications and computer aided target analysis and fire planning functions. An ancillary but critical issue to be addressed within this project definition is the requirement for an artillery fired, hard structure penetrating munition. The sensor systems tentatively identified for this program include a ground-netted radar system, an airborne radar (Pave Mover) system, an Electro-Optical-Infrared (EO-IR) camera system, a coherent emitter location and targeting system. The survivable communications could be provided by the DARPA developed Packet Radio System. A potential candidate for the computer-aided analysis and targeting system might be a modified version of the Target Analysis and Planning System (TAPS) being tested in Europe by V Corps for tactical nuclear target planning.

G. RELATED ACTIVITIES:

DARPA, in its Korean Improvements Assessment Studies initiated in January 1980, has identified short-term (0-3 years) and mid-term (4-7 years) improvements that might be undertaken by U.S. and Korean Forces to counter the very real threat posed by North Korea's expanding armed forces. These studies also resulted in recommended R&D initiatives that might be undertaken to assist CFC-K in deterring NK aggression or in defeating NK forces if deterrence fails.

- H. WORK PERFORMED BY: Currently about 98% of the work is performed by industry and about 2% by DoD in-house. The principal contractor for the initial study phase was BDM Corporation of McLean, Virginia.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #EE-15
Program Element: #62711E
DoD Mission Area: 530

Title: Project SORAK (Korean Equipment Upgrade)
Title: Experimental Evaluation of Major Innovative Techniques
Budget Activity: 1. Technology Base

1. FY 1981 and Prior Accomplishments: Project SORAK was not funded in FY 1981 or prior years.
2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: During FY 1982 (Phase O), the currently proposed technologies will be further evaluated to include technical, engineering and operational trade-off assessments against other options and alternatives. The product of such planning and assessment activity will be the Project SORAK Definition, System Architecture, the Engineering Integration Plan and the Management Plan. Complete program plans, schedules, life cycle costs, and cost-sharing arrangements will be developed in cooperation with appropriate Army and Air Force commands and host nation officials. Upon completion of Phase O, the Project would proceed with subsystem hardware development and fabrication (Phase I), beginning in FY 1983. Upon completion of the hardware development and fabrication phase for each of the selected subsystems (current candidates: netted radar, airborne radar, CELT, EO-IR, Packet Radio, and TAPS), the Phase II subsystem field testing could begin. Phase III is envisioned as a series of subsystem demonstrations
3. Program to Completion: Phase IV is the overall system integration and test while Phase V is the final system demonstration The total system of sensors, communications and computer aided target planning function is expected to be fully functional
4. Milestones: The milestones for the SORAK technology demonstration are as follows:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
SORAK	late FY 1982	Phase O, Project Definition, System Architectural Develop- ment, Engineering Integration Plan, Management Plan	New Milestone
--	mid FY 1983	Phase I, Subsystem Hardware Acquisition and Development	New Milestone

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Project: #EE-15
 Program Element: #62711E
 DoD Mission Area: 530

Title: Project SORAK (Korean Equipment Upgrade)
 Title: Experimental Evaluation of Major Innovative Techniques
 Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
--	mid FY 1984	Phase II, Subsystem Field Testing -	New Milestone
--	late FY 1984	Phase III, Subsystem Demonstra- tion	New Milestone
--	mid FY 1984	Phase IV, Full System Integra- tion and Test	New Milestone
--	mid FY 1985	Phase V, Full System Demon- stration	New Milestone

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate*</u>	<u>FY 1984 Estimate*</u>
Project SORAK	-0-	5,000	10,000	10,000

*Provides DARPA technology and engineering support, but assumes supplemental funding within Army and Air Force, as well as a funding or support arrangement with the host nation.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62712E
DoD Mission Area: 530

Title: Materials Processing Technology
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in Thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
TOTAL FOR PROGRAM ELEMENT		\$ 11,977	\$ 13,300	\$ 15,400	\$ 19,300	Continuing	N/A
MPT-1	Material Processing Technology	9,838	11,350	12,875	16,000	Continuing	N/A
MPT-2	Electronic & Optical Device Technology	2,139	1,950	2,525	3,300	Continuing	N/A

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element develops novel materials, processes, structures and device technologies that will give new capability to future defense weapon systems. Examples are: application of rapidly solidified superalloys to gas turbine engine components; development of ceramics and carbon/carbon composites for high temperature engine applications; advanced fabrication methods for structural materials, including ultra-high speed and laser-aided machining; metal-matrix composites for space structures and for high-stiffness penetrators; acoustic emission for dynamic crack detection on aircraft; quantitative non-destructive evaluation; engine disk retirement for cause; development of high strain rate materials capability for improved armor and penetrators; and Intelligent Task Automation for increased productivity and/or reliability of Defense system assemblies. These efforts will provide significant systems performance advances, and are also aimed at reducing acquisition and maintenance costs of present and future DOD systems through advanced materials processing and in-service inspection technologies. Efforts in MPT-2 pursue development of innovative processes for the fabrication of performance intensive digital, microwave, and optical monolithic integrated circuits.

C. BASIS FOR FY 1983 RDT&E REQUEST: Programs will be undertaken to demonstrate carbon/carbon composites gas turbine engine components operating at temperatures up 1975°C; and metal matrix (graphite/magnesium) composite structures for space applications, using a satellite antenna as a test vehicle. The effort to demonstrate a dual

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62712E
DoD Mission Area: 530

Title: Materials Processing Technology
Budget Activity: 1. Technology Base

alloy radial turbine wheel based on rapid solidification technology will be continued. If successful, effort to develop metal matrix composites based on casting and continuous silicon carbide reinforcement will be transferred to this effort from PE #61101E (MS-1) for demonstration of a deep-submersible, lightweight hull component. New technological opportunities in the ultra-high speed and laser-aided machining and the monitoring and control of plasma arc welding will be pursued. Quantitative non-destructive evaluation technology will include development of predictive capability for the failure of structural components based upon the coupling of non-destructive ultrasonic measurements with fracture mechanics principles, continuation of a joint program with the Air Force to develop a "retirement-for-cause" strategy to replace the current "retirement-by-design" approach for the F-100 and TF-30 engines, and laboratory evaluation of advanced acoustic emission sensors and data processing concepts for uniquely identifying fatigue crack growth in aluminum alloys. The Intelligent Task Automation effort will concentrate on generic technologies for sophisticated robotics such as: three dimensional vision, tactile sensing, floppy arms, and end-point sensing. In project MPT-2, electronic materials processing, demonstration of directed energy processing to fabricate microelectronic devices and circuits in unique materials systems and/or having feature sizes approaching 0.1 micrometer will continue, as exemplified by fabrication of 3-dimensional circuit structures by laser processing. Monolithic gallium arsenide microwave integrated circuit development will be completed with transfer of the present jointly funded program to full Navy funding.

- D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Based on promising initial results of development of coatings for carbon/carbon composites, the demonstration of the capability of these materials to operate at temperatures of 1975°C is being conducted. These materials have been tested at 1900°C for five minutes. The milestone to perform a hot spin pit test of a carbon/carbon component during FY 1982 is still viable. Efforts initiated in FY 1982 include the dual alloy radial turbine and intelligent task automation. In MPT-2 the monolithic microwave integrated circuit effort will end with full transfer to the Navy for continued development. New process capabilities for formation of connector patterns, thin insulators, and use of low voltage electron beam lithographic patterning and near-monolayer lithographic resists will be explored.

- E. OTHER APPROPRIATION FUNDS: None

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MPT-1
Program Element: #62712E
DoD Mission Area: 530

Title: Materials Processing Technology
Title: Materials Processing Technology
Budget Activity: 1. Technology Base

- F. **DETAILED BACKGROUND AND DESCRIPTION:** The objectives of this program are: (1) development of rapid solidification rate (RSR) turbine blades and vanes for jet engines; this is the first program in the history of jet engines to explore simultaneously three technologies (alloy development, coating chemistry, and cooling design) with an objective of a 300°C increase in turbine inlet temperature and defined milestones for establishment of production methods; (2) flaw acceptance criteria and advanced techniques for non-destructive evaluation which will lower defense costs by both minimizing overly-conservative design practices and facilitating maintenance-for-cause strategies and (3) advanced manufacturing process technologies in support of DoD advanced weapons systems. DARPA has pioneered ceramic and carbon/carbon composite materials for turbines and other advanced propulsion power plants because these materials systems promise engine designs with reduced weight, increased performance, reduced dependence on costly and critical alloy materials, lower specific fuel consumption, and reduced pollutants. Unique fabrication methods being explored include ultra-high speed, laser-aided machining, and self-optimizing welding processes. Non-destructive evaluation of performance-limiting defects includes: the development of analytical procedures for inverting ultrasonic data to obtain quantitative measures of flaw size, shape, and orientation and thereby to determine, with the aid of fracture mechanics theory, the criticality of the flaw to component life; the establishment of a comprehensive strategy for accepting ceramic components based on quantitative measurements of the flaws in critical structures; and the extension of new non-destructive evaluation technologies to permit the development of analytical maintenance procedures. Today's robots lack vision, touch, and end point sensing. The development of these and other technologies will have a significant impact on intelligent task automation for the fabrication of defense systems.
- G. **RELATED ACTIVITIES:** Programs to develop high performance ceramic materials for gas turbine engine components are being conducted by all services, National Aeronautics and Space Administration, and the Department of Energy; plans and programs are reviewed by an interagency ceramics coordinating committee. The Air Force is providing a share of the funding for the Radial Wafer Blade Program. Materials development related to improved armor and penetrators is coordinated with other service and agency efforts. Generally, the Services are sponsoring different aspects related to unique manufacturing methods than those pursued by DARPA, and unnecessary duplication of effort is prevented by direct coordination with the Office of Under Secretary of Defense for Research and Engineering (USDR&E) and the Manufacturing Technology Advisory Group (MTAG). There are programs in non-destructive evaluation in all three Services; the DARPA program is coordinated by an interagency advisory board. The intelligent task

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automation program is related to and complemented by efforts by the Air Force Wright Aeronautical Laboratories and the National Bureau of Standards.

- H. WORK PERFORMED BY: Approximately 85% of this work is performed by industry, 10% by universities, and 5% in-house. The top industrial performers are: Pratt and Whitney Aircraft Group, West Palm Beach, Florida; General Electric Company, Valley Forge, Pennsylvania; Teledyne CAE, Toledo, Ohio; and Battelle Pacific Northwest Laboratory, Richland, Washington. The universities are: Massachusetts Institute of Technology, Cambridge, Massachusetts; Cornell University, Ithaca, New York; University of Michigan, Ann Arbor, Michigan; and Ames Laboratory, Iowa State University, Ames, Iowa. The Naval Research Laboratory, Washington, D.C. is our in-house performer.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Fundamental understanding of the factors influencing the performance of metal matrix composite penetrators was developed, and the information has been transferred to other Services. An important demonstration of the feasibility of radial wafer blade technology was achieved through the successful operation of two first stage turbine blades in an engine ground test. The engine was run under simulated tactical air command mission cycles, and the blades experienced no problems after twenty-four such cycles. A heretofore unsuspected problem associated with the destructive effects of contact stresses between static ceramic gas turbine engine components was encountered. Significant new understanding of the contact stress phenomenon has been achieved, methods to overcome the problem were developed, and should enhance the potential for success in virtually all other programs to develop ceramic gas turbine engine components. Plain carbon steels containing 1.0% and 2.3% carbon have been modified by thermal-mechanical working to be superplastic (readily forgeable) at warm temperatures, while maintaining strength and toughness at room temperatures. Methods for laminating multiple layers of ultra-high carbon steel with intervening layers of ductile iron were developed. Significant promise for military applications of these laminated structures have been identified. A major advance was achieved using laser assisted machining to shape silicon carbide and silicon nitride materials which previously could only be ground or polished to obtain a finished part. The capability of machining metallic parts at high speed with greatly improved surface finish with laser assistance was also demonstrated. New tooling for high speed machining has increased

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tool life six fold. Process and production cost models for Diffusion Solidification Processing were completed, and experimental castings demonstrated a potential of this processing technique for automating the investment casting of complex ferrous parts to near-net shape. Significant advances in quantitative non-destructive evaluation included: demonstration of a linear correlation between acoustic emission events and fatigue crack growth during in-flight aircraft testing; feasibility demonstration of a phased-array ultrasonic imaging system based on digital electronic technology; experimental validation of low-frequency ultrasonic inversion methodology for extracting critical material flaw parameters of structural components; and the development of an ultrasonic approach to measure microcracks in aluminum alloys.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: In FY 1982, development of optimum alloys and processing for blades and vanes is continuing under the Radial Wafer Blade program. Verification of coating performance, cooling designs and prototype manufacturing processes is being undertaken. Disks made of carbon/carbon material are being spin-tested to validate their suitability for cruise missile engines. Efforts are underway to design and fabricate a magnesium/graphite metal matrix composite satellite antenna structure and demonstrate its anticipated performance advantages. Theoretical efforts in the quantitative non-destructive evaluation program are being more sharply focused while experimental verification of the theory is conducted in ongoing efforts. These efforts include the coupling of quantitative non-destructive measurements with fracture mechanics to predict remaining life in critical aircraft engines and structures. Adaptive imaging and ultrasonic inversion techniques for flaw characterization and component life prediction is being demonstrated under simulated field inspection conditions to validate the methodology for transfer to the Services. Development of a "retirement-for-cause" capability for F-100 engine disks is being expanded to include detailed analysis of the non-destructive inspection requirements and crack growth rates in candidate disks.

In FY 1983, a program will continue with the Air Force, to develop and validate inspection and analysis capabilities for retiring F-100 engine disks for cause and demonstrating these procedures on real components. These components will be subjected to spin-pit testing to validate the overall methodology. The inflight acoustic emission program will complete a detailed analysis of the requirements and technical capabilities for the inflight demonstration phase. The ultra-high speed machining and advanced welding programs will establish limits of the technology for improving manufacturing productivity. In the radial wafer blade program, blade cooling will be

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optimized, materials characterization will be completed, internal and external coatings will be developed, and the first set of F-100 engine hardware will be completed for a full prototype demonstration. An effort to apply rapid solidification rate technology to the fabrication of a dual alloy radial turbine wheel will transfer to this program with the objective of achieving 1200°C uncooled operating temperature, and heretofore unattained thermal efficiency in small gas turbines for transportable power generator sets and other shaft driven defense equipment. The metal matrix composite materials program will complete evaluation of antenna rib component based on graphite-magnesium composites, and complete fabrication of the high-gain antenna support boom for the NASA Space Telescope program. The laser-aided machining program will be nearly complete, with designs for the first generation processors, computer control, and phenomenological models complete, and a facility set up for routine feasibility evaluation. In FY 1983, major efforts to demonstrate rapid solidification technology benefits in gas turbine engine components will be continued (Radial Wafer Blade and Dual Alloy Radial Turbine); transfer of plasma sprayed combustion feasibility demonstration will be made to this program; the entire retirement-for-cause methodology will be evaluated by performing "retirement-for-cause" during spin-pit testing; and generic technologies will be researched for intelligent task automation.

3. Program to Completion: Successful materials science projects related to materials processing research (PE #61101E, MS-1) will be transferred into this program element for final feasibility demonstration before transfer to the Services. In the unique manufacturing area, efforts will continue to stress major cost reductions through high-speed, in line, quality and process control; continuous processing; and product reproducibility at the unit operation scale. Efforts will continue to improve our ability to utilize advanced materials and structures safely and economically through advance non-destructive evaluation technologies and materials failure modeling. The intelligent task automation program will demonstrate significantly improved technologies and integrate these into a system to demonstrate a Service-related fabrication or assembly task.

4. Milestones: The milestones reported in the FY 1982 Descriptive Summary have been completed or are expected to be completed on schedule except as noted below:

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Program Element: #62712E
DoD Mission Area: 530

Title: Materials Processing Technology
Title: Materials Processing Technology
Budget Activity: 1. Technology Base

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes for Milestones Reported in FY 1982 Descriptive Summaries</u>
Mid FY 1981	--	Demonstrate Portable Ultra-sonic Imager.	Failed.
Late FY 1981	Early FY 1982	Spin-test coated carbon-carbon disk at 100,000 rpm at 1975°C.	Slipped milestone due to delivery delays.
--	Late FY 1982	Demonstrate Graphite-Magnesium Composite Antenna Rib.	New Milestone.
--	Late FY 1983	Fabricate Turbine Engine Vanes from Rapidly Solidified Nickel Base Alloy.	New Milestone.
--	Late FY 1983	Transfer new High Speed Machining Techniques to Services for Implementation.	New Milestone.
--	Early FY 1984	Demonstrate Dual Alloy Radial Turbine.	New Milestone.

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Materials Processing Technology	9,838	11,350	12,875	16,000

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Project: #MPT-1
Program Element: #62712E
DoD Mission Area: 530

Title: Materials Processing Technology
Title: Materials Processing Technology
Budget Activity: 1. Technology Base

The core program in quantitative non-destructive evaluation research, the F-100 Retirement for Cause program, the ultra-high-speed machining program and the radial wafer blade program are jointly funded with the Air Force. Efforts are underway to establish tri-Service support for the core program in non-destructive evaluation research.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MPT-2
Program Element: #62712E
DoD Mission Area: 530

Title: Electronic and Optical Device Technology
Title: Materials Processing Technology
Budget Activity: 1. Technology Base

- F. **DETAILED BACKGROUND AND DESCRIPTION:** The feasibility of using beam process sequences and direct ion implantation in GaAs for fabricating digital and microwave integrated circuits (IC's), and techniques for maskless fabrication of IC's using focused ion, electron, and laser beams was first demonstrated in PE #61101E, MS-2. This effort seeks to demonstrate utility of these techniques to provide high performance, submicron feature ICs and device structures for radar, electronic countermeasures, and related DoD systems. Low power, radiation hard gallium arsenide digital IC Technology also initially demonstrated in PE 61101E, Project MS-2, will be further developed in this project beginning in FY 1983 for survivable satellite systems.
- G. **RELATED ACTIVITIES:** Development in electronic device processing methods are coupled to the Services' programs through the DARPA agent and frequently through joint funding agreements, to assure that no unnecessary duplication of research with the Services or other DoD agencies occurs.
- H. **WORK PERFORMED BY:** Approximately 59% of this work is performed by industry, 40% by universities, and 1% in-house. The top industrial performers are: Westinghouse Electric Company, Baltimore, MD., and Pittsburgh, PA; Spire Corporation, Burlington, MA; and General Electric Company, Oswego, N.Y. The top university performers are: Stanford University, Palo Alto, CA; Cornell University, Ithaca, N.Y.; and the Massachusetts Institute of Technology, Cambridge, Mass. The in-house performer is the Naval Research Laboratory, Washington, D.C.
- I. **PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:**
1. **FY 1981 and Prior Accomplishments:** Integrated circuit process development and process validation test patterns were conceived which were incorporated into the Very High Speed Integration Circuit (VHSIC) program initiated by the Services in FY 1980. Feasibility of doing microfabrication at dimensions of 0.1 micrometer with focused ion beams was demonstrated, and viability of new laser processed silicon-on-insulator IC materials systems and the first 3-dimensional integrated circuit structures were verified by integrated circuits test structure fabrication and measurement. Monolithic gallium arsenide microwave amplifier technology achieving one-watt output and operation over a whole octave bandwidth (5-10 GHz) was demonstrated.

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Project: #MPT-2
Program Element: #62712E
DoD Mission Area: 530

Title: Electronic and Optical Device Technology
Title: Materials Processing Technology
Budget Activity: 1. Technology Base

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Fabrication processes for very-large-scale integrated circuits having submicron feature sizes using laser, electron, and ion beam processing are being demonstrated on appropriate test structures. Emphasis is on providing data on beam processing procedures to determine their utility vis-a-vis conventional integrated circuit fabrication methods for military integrated circuits (digital and microwave) manufacturing. These efforts will demonstrate syntheses, integration, and verification on a microcircuit scale, in a complete circuit fabrication sequence, the innovative materials, processing, and device concepts which have emerged from PE 61101E, project MS-2 (Electronic and Optical Devices and Materials).

In FY 1983, fabrication of semiconductor device structures having minimum feature sizes approaching 0.1 micrometer using focused ion and laser beam processing will be done to identify any unforeseen problems in use of beam processing concepts in a manufacturing environment. Development of a monolithic gallium arsenide microwave power transmitter will be completed with a demonstrated output of 3-watts in the 8 to 12 GHz band with 18 dB gain. If suitable manufacturing processes are demonstrated the program will be fully transferred to the Navy in the beginning of FY 1983. Development of radiation hard GaAs ICs will be initiated.

In FY 1984 GaAs radiation hardened IC technology will be expanded and will focus on gate array technology for low cost customized IC's. Beam processing development will continue to develop submicron feature size fabrication, and expand efforts in materials systems for three-dimensional device structures.

3. Program to Completion: In the electronic device processing area, beam processing demonstration circuits having submicron feature sizes, and carrying new architecture/design/test concepts, will be fabricated for test in a selected system. This effort is continuing due to the exceptional importance of information and signal processing capability to defense systems. As beam processing is demonstrated in silicon these processing concepts will be transferred to other electronic materials, such as gallium arsenide and indium phosphide, whose basic materials properties offer major functional improvements to electronic circuits. Due to the importance of radiation hard ICs for survivable satellite surveillance and communication systems, development of radiation hard GaAs devices will expand.

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 Program Element: #62712E
 DoD Mission Area: 530

Title: Electronic and Optical Device Technology
 Title: Materials Processing Technology
 Budget Activity: 1. Technology Base

4. Milestones: The milestones reported in the FY 1982 Descriptive Summary have been completed or are expected to be completed on schedule, except as noted below:

<u>Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes for Milestones Reported in FY 1982 Descriptive Summaries</u>
Late FY 1982	Late FY 1982	Fabricate and test focused ion beam processed transistors having features less than or equal to 0.15 micrometers.	
Late FY 1982	Late FY 1982	Demonstrate a monolithic 3-watt, 8-12 gigahertz, power amplifier with 18 db power gain.	
--	Late FY 1983	Demonstrate IC customization using selective submicron-sized deep UV laser processing.	New Milestone.
Late FY 1983	Late FY 1984	Determine feasibility of low voltage, high resolution monolayer resist electron beam lithography.	Mechanics and experiments of inter-university research efforts and transfer of monolayer thin film preparation and processing techniques requires additional time.
--	Late FY 1984	Feasibility of fabricating. 0.01 um (100 Å) device features using focused ion beams.	New Milestone.

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 Program Element: #62712E
 DoD Mission Area: 530

Title: Electronic and Optical Device Technology
 Title: Materials Processing Technology
 Budget Activity: 1. Technology Base

5. Resources: (\$ in Thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Electronic and Optical Device Technology	2,139	1,950	2,525	3,300

The microelectronic beam processing efforts are funded jointly and/or cooperatively by National Science Foundation, Air Force Office of Scientific Research and the Naval Air Systems Command.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62714E
DoD Mission Area: 530

Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

A. RESOURCES: (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		\$15,068	\$ 16,800	\$ 17,300	\$ 22,500	Continuing	N A
*NM-1	Detection and Discrimination Research	9,068	10,800	8,700	13,350	Continuing	N/A
*NM-2	Yield Estimation	6,000	6,000	8,600	9,150	Continuing	N/A

* Note: In the FY 1982 RDT&E Descriptive Summary, these two subprograms were reported separately. They are combined in this year's summary for management purposes.

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Nuclear Monitoring Program conducts research and development to provide new technological options for enhancing U.S. capability to monitor nuclear explosion events. The program also provides technical information needed for developing sound national policy for negotiations on treaties limiting nuclear testing and provides technical support for US participation in treaty-related international activities. The need for this program is exemplified by the unexpected initiation of negotiations for an explosion yield threshold treaty in 1974, requiring the development, in a period of less than a year, of special monitoring provisions for the Peaceful Nuclear Explosion Treaty (PNET). The unpredictable course of negotiations for a comprehensive test-ban treaty involving, for example, definition of numbers of internal monitoring stations, their characteristics, and on-site inspection procedures, have required rapid provision of sound factual information for use by policymakers. At present, special technical efforts are required to provide policymakers with technical options for verification of an explosion yield threshold treaty. The Program is divided into three broad project areas: one which develops processing methods to collect and manage the data used to monitor foreign nuclear explosion tests; a second which is concerned with developing new techniques for analyzing and interpreting

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62714E
DoD Mission Area: 530

Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

the data, using recent advances in fundamental understanding of nuclear explosion phenomena; and a third which is concerned with development of non-seismic methods to monitor nuclear explosions in deep space, in the atmosphere and underground.

- C. **BASIS FOR FY 1983 RDT&E REQUEST:** Previous work in areas related to nuclear test verification has been conducted under Program Element 62701E, Nuclear Monitoring Research (FY 1980 and prior years); and Program Element 61101E, Nuclear Test Verification (Fiscal Years 1979 and 1980). The research under these elements has provided significant advances in fundamental understanding of geophysics and instrument design. These results have significantly affected the operational characteristics of deployed monitoring systems and the analytical procedures used routinely to interpret the data from these systems. International discussions on a complete ban on nuclear weapons testing, as well as continued concern regarding verification of compliance with the 150-kiloton threshold agreement, have focused attention on a number of highly technical issues involved in test detection, identification, and accurate yield determination. Resolution of these issues requires additional highly specialized research.

In response to these technology requirements, the FY 1983 Nuclear Monitoring Program will continue the following programs: in a cooperative effort with the National Science Foundation, an exploratory borehole ocean-bottom seismic sensor system is being designed and installed to establish the fundamental seismological characteristics of the deep ocean crust and to determine the engineering feasibility of installing such systems for verifying future test ban treaties; to support initiatives toward international cooperative measures for verifying future test ban treaties, design development will continue for an advanced international data center together with the data handling and processing procedures required for this center; fundamental seismological and geophysical research into the character of earthquake and explosion sources will be conducted with particular emphasis on high frequency seismological studies to provide a sound technical basis for guiding negotiations and improving the capability to use seismic stations which may be installed in the Soviet Union under provisions of a future comprehensive or reduced threshold test ban treaty; application of new monitoring methods to supplement seismic monitoring of the underground environment and to enhance capabilities in other environments, will be investigated; exploratory development of advanced non-statistical methods to improve the accuracy of yield estimation will continue, with emphasis on refinement of seismic measurements and their

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Title: Nuclear Monitoring
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interpretation; potential evasive testing techniques will be investigated and effective countermeasures developed; to support development and validation of fundamental signal generation and propagation theory for underground explosions, a program of explosive field experiments will be examined.

- D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: In FY 1982, the total funds for the Nuclear Monitoring Program are estimated to be \$16,800,000 which is \$1,200,000 greater than the amount reported in the FY 1982 Descriptive Summary. Emphasis has been placed on accelerating efforts to develop a prototype ocean-based seismic monitoring system, and to expand development of new sophisticated, physically sound, methods to estimate the yield of underground nuclear explosions.
- E. OTHER APPROPRIATION FUNDS: None

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #NM-1/2
Program Element: #62714E
DoD Mission Area: 530

Title: Nuclear Monitoring
Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

- F. DETAILED BACKGROUND AND DESCRIPTION: Verification of any treaty entirely prohibiting nuclear explosion tests is limited by the ability to distinguish the seismic signals from nuclear explosions and earthquakes. For large explosions that are well recorded at large (2,000 km) distances, the problem is essentially solved. However, small explosions are only detected at closer ranges, leading to the requirement for in-country monitoring stations in the Soviet Union. In order to make best use of these stations, as well as existing stations near the borders of the USSR, research has been intensified to improve the capability to interpret seismic data recorded at "regional" distances (less than 2,000 kilometers) where they are dominated by poorly understood high frequency signals. However, these signals, if properly understood, could be extremely beneficial since they have the potential for revealing more information about the source. Also important for data from all distances is automation of many of the detection, event location and event discrimination tasks that are now done manually

Recent advances in marine technology indicate that reliable recovery of high quality seismic data from emplacements beneath the ocean floor may be possible.

A demonstration that ocean-based stations can be installed in the deep ocean was successfully completed, and testing of components of a complete system are underway.

Technology advances in seismic instrumentation allow large dynamic range recording of broad bandwidth signals. To realize the significant increase in the information that can potentially be extracted from these signals, it is necessary to develop new automatic data analysis algorithms and management techniques, since increased data volume renders existing methods obsolete. New processing techniques are particularly important for supporting deployment of special monitoring stations for treaty verification purposes, especially since negotiations for future nuclear test ban treaties are likely to provide for international exchange of seismic data. Preliminary studies by a group of experts convened under the U.N. Conference of the Committee on Disarmament have recommended establishment of international data centers for this purpose in Washington and Moscow and no adequate facility currently exists. An advanced seismic data center is being developed to support needed research in signal processing, as well as to serve as a prototype system which can be expanded to support an international test ban treaty, if required.

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An important part of the program continues to be fundamental studies of the nature of earthquake and explosion sources and the effects of earth structure on seismic wave character. The objective is to incorporate fundamental advances in geophysics, seismology, and data processing methods to significantly improve the technological capability to verify test ban treaties. Recent theoretical advances, together with the completion of a worldwide research network of high quality digital stations, encourage pursuit of fundamental and important changes in the procedures for source identification. The concept is to use the physical and geometric properties of sources, rather than statistical measures of historical data, allowing application to areas for which prior recordings of earthquake and explosion signals are lacking.

A major focus of the program is an improvement of capabilities to monitor compliance with the (unratified) Threshold Test Ban Treaty (TTBT), which limits the yields of U.S. and Soviet test to 150 Kt and below. the current yield estimates are uncertain

because of deficiencies in our fundamental understanding of the physical processes involved in the generation of seismic waves and their propagation to distant (thousands of kilometers) seismometers. The Peaceful Nuclear Explosion Treaty (PNET) is even more difficult to monitor than the TTBT, since it permits explosions in a wide variety of geophysical settings. For these reasons this project includes theoretical and experimental research to better understand the explosion source and its coupling into seismic waves; study of the geophysical setting of U.S. and Soviet test sites; and development of theoretical models for the propagation of explosion seismic waves.

With increasing proliferation of nuclear capability, the U.S. must be concerned with detecting and identifying nuclear testing in all environments, requiring research to identify non-seismic indicators of nuclear explosions. Several satellite-borne sensors are under active development or in a conceptual study phase. These include development of a high resolution gamma-ray spectrometer,

Other non-seismic techniques are also being studied to determine their capability to complement and enhance current techniques to detect, locate, and identify underground or atmospheric nuclear explosions.

- G. RELATED ACTIVITIES: Complementary research to improve capabilities to verify nuclear test ban treaties is being carried out by the National Laboratories of the Department of Energy and by the Air Force Technical

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Applications Center. These complementary efforts are coordinated through existing interagency agreements and periodic working level coordination meetings. In the development of the Marine Seismic System, arrangements have been made with the National Science Foundation for jointly supporting the deep sea drilling operations using the ship GLOMAR CHALLENGER.

- H. WORK PERFORMED BY: Twelve percent of the work under this task is performed by universities, seventy-five percent by industrial contractors, nine percent by in-house laboratories, and four percent by federal contract research centers. University contractors include: St. Louis University, St. Louis, Missouri; University of Nevada, Reno; Massachusetts Institute of Technology, Cambridge, Massachusetts; University of California, San Diego, California; University of California, Berkeley, California; Columbia University, New York, New York; California Institute of Technology, Pasadena, California; Pennsylvania State University, State College, Pennsylvania; University of Southern California, Los Angeles, California; Southern Methodist University, Dallas, Texas; and University of Colorado, Boulder, Colorado. Industrial contractors include Teledyne Geotech, Garland, Texas and Alexandria, Virginia; Sierra Geophysics, Seattle, Washington; ENSCO, Inc., Springfield, Virginia and Indian Harbour Beach, Florida; Gould, Inc., Glen Burnie, Maryland; Systems, Science and Software, La Jolla, California; Global Marine Development, Inc., Newport Beach, California; Pacific Sierra Research, Santa Monica, California; Woodward-Clyde Associates, Pasadena, California; Lockheed Missiles and Space Company, Palo Alto, California; SRI International, Menlo Park, California; Physics Applications, Inc., Fremont, California; and Mission Research Corp., Santa Barbara, California. Participating in-house Government laboratories include the Naval Ocean Research and Development Activity, Bay Saint Louis, Mississippi; the National Oceanic and Atmospheric Administration, Boulder, Colorado; and the US Geological Survey, Denver, Colorado. The Federal Contract Research Center is MIT Lincoln Laboratory, Lexington, Massachusetts.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: This program was initiated under Program Elements #61101E and #62701E. The main thrust in FY 1979 was to assess the technology and identify those areas expected to provide the greatest payoff in future R&D efforts. Promising areas were selected at the end of FY 1981 to be continued under Program Element #62714E, and these are described below.

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Title: Nuclear Monitoring
Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

In developing techniques for regional (less than 2,000 km) monitoring of the USSR, the emphasis was on observational and theoretical modeling studies of crust and upper-mantle structure, and on attenuation and propagation effects at regional distances. Also, development of deterministic seismic discrimination methodology continued with the improvement of models for earthquake and underground explosion sources. A major development was completion of a comprehensive experiment to test various discrimination techniques as applied to USSR events. This experiment focussed attention on those areas where additional research efforts were needed to overcome source identification deficiencies.

New signal processing techniques involving automated signal recognition and characterization procedures were developed and demonstrated to have potential to replace the need for human visual analysis. The design of a data processing facility to test these concepts was completed, and a prototype system was used to support U.S. experiments in international data exchange anticipated under future test ban treaties.

Those aspects of the ocean-bottom environment which could influence deployment and operation of ocean-bottom seismic sensors for monitoring the seismically active ocean margin regions of the world were characterized and preliminary at-sea site surveys were undertaken. The concept was tested in an experiment in the mid-Atlantic in which a seismometer was successfully installed and recovered from a borehole 600 meters beneath the sea floor in 4,500 meters of water using the drill ship GLOMAR CHALLENGER. The design of the ocean-based sensor system was completed and preparations were made for the installation of a prototype station in August 1982.

Substantial progress was made in understanding the source and path characteristics that control the seismic signals used for estimating the yield of underground explosions. A number of studies of the geophysical setting of French, Soviet, and U.S. test sites were completed to provide a basis for focusing theoretical studies on a realistic range of source conditions. Theoretical models of underground explosion sources and seismic wave propagation were developed to predict the character of seismic signals as a function of depth of burial, near source rock type, and geologic structure. Model studies and laboratory tests were also conducted to identify effects which could influence yield estimates. To increase understanding of the effects of earth structure, the program included deep seismic reflection profiling at the Nevada Test Site (NTS) and operation of digital seismic

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Project: #NM-1/2
Program Element: #62714E
DoD Mission Area: 530

Title: Nuclear Monitoring
Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

stations at sites of U.S. explosions.

To help in development and validation of source and propagation models, a program of close-in seismic source measurements was initiated at the NTS and small-scale laboratory and field testing was initiated. It was recognized that an experimental program including nuclear and large chemical explosions was needed for full validation of theoretical models and techniques, so preliminary planning for a dedicated experimental program was undertaken.

To counter potential efforts to evade detection of testing techniques designed for data from high quality digital networks were evaluated against simulations of explosion signals hidden in earthquake signals. Fundamental studies of the effects of cavities on explosion generation of signals were begun. Developmental efforts to support options for new non-seismic monitoring included studies of electromagnetic, ionospheric, and other types of signals potentially generated by nuclear explosions. Evaluation of new developments in satellite-borne detectors was also undertaken.

2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: The FY 1982 program includes work to improve seismic instrumentation, data processing techniques, explosion/earthquake discrimination, and explosion yield determination. The instrumentation work includes completion of the development and field evaluation of a sensitive high frequency borehole seismometer. The design of a system combining strain and inertial measurements is also being completed. Design and fabrication of an experimental ocean bottom sensor system is underway and the full system is to be installed and tested in cooperation with the National Science Foundation

The emphasis of the data processing work is on automating as many as possible of the detection, location and event identification tasks now done manually, as well as on techniques to manage the large volume of digital data now available for accomplishing these tasks. A new Seismic Data Center is being established in the Washington area to focus those efforts, as well as to be available to meet any U.S. obligations undertaken as part of future test ban agreements.

The emphasis of the seismic discrimination or event identification research is on the incorporation of regional data into the algorithms and on integrating these algorithms with modern data processing technology. Temporary arrays optimized to enhance high frequency signals are being deployed in Norway, and other data are being collected

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #NM-1/2
Program Element: #62714E
DoD Mission Area: 530

Title: Nuclear Monitoring
Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

to guide the design of arrays to detect regional (less than 2,000 km) signals. Such arrays and the strain - inertial system provide additional options for possible deployment under future test ban agreements. Another important part of the program is development of techniques to counter potential treaty evasion schemes. A computer data analysis system to detect an explosion hidden in the signals from an earthquake is to be completed

The emphasis of the FY 1982 yield estimation work is on a focusing of results developed in previous years to complete the development and prooftesting of those concepts that appear to offer opportunities for significant improvement. A comprehensive review of the technical issues associated with yield estimation was completed in FY 1981 and serves as a guide for the FY 1982 - 1984 program. Major deficiencies remain in our understanding of source coupling to seismic waves, attenuation, generation of surface waves, and in our techniques for recognizing and compensating for such effects. The FY 1982 program includes efforts to address each of these deficiencies. In particular, a large digital data base of explosion recordings is being collected for thoroughly evaluating previously developed yield estimation techniques and to provide a base on which new approaches to this problem can be developed. This evaluation is beginning in FY 1982. Source coupling issues are being addressed with calculations, small-scale laboratory experiments and small-scale chemical explosions in a Texas salt dome. Efforts to develop techniques to remotely estimate seismic wave attenuation beneath foreign sites are continuing, along with efforts to collect relevant data.

Development of non-seismic detection and identification techniques is included in the FY 1982 program. Several satellite-based techniques are in the proof-of-concept stage. These include

a high-resolution gamma ray spectrometer
analysis techniques to measure small surface effects. Also under study is a neutrino
detector

Many of the efforts begun in FY 1982 and previous years will be completed in FY 1983. The evaluation of the high frequency borehole seismometer and the strain-inertial seismometer is to be completed, so these instruments will be ready

The data from the FY 1982 test of the ocean bottom seismometer system
will be available for analysis, and further tests are scheduled for FY 1983.

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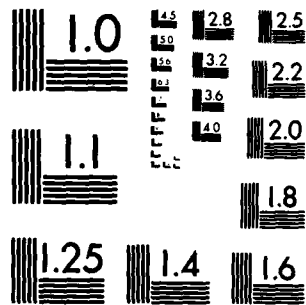
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JUSTIFICATION OF ESTIMATES FOR FISCAL YEAR 1983 SUBMITTED TO CO--ETC(U)
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #NM-1/2
Program Element: #62714E
DoD Mission Area: 530

Title: Nuclear Monitoring
Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

The improved capability to detect, locate and identify nuclear explosions will be prooftested on an integrated system which automates most of these functions. Some deficiencies in the algorithms are expected, so some further development effort is anticipated in FY 1983. The prototype Seismic Data Center is to be operational and the program includes an integration of new data analysis algorithms with the versatile data handling capabilities of that center. The high frequency array design study will be completed, providing information to plan further evaluation studies if warranted. Also, work will be initiated to develop procedures to counter attempts to evade seismic detection in remote areas of the world.

The comprehensive evaluation of simple data correction techniques to improve yield estimates which is beginning in FY 1982 is to be completed in FY 1983. This should clarify the contribution of research to conventional yield estimation methods and set the stage for completing the development and evaluation of methods which greatly expand the amount of information derived from the waveform, thus representing a fundamental change in yield estimation procedure. Also, there will be a continued emphasis on improving estimates for attenuation and source coupling effects.

The small-scale salt dome tests will be completed. If the results are sufficiently promising, the experimental technique will be used in another material, probably granite. The of data analysis efforts in FY 1982 and 1983 are expected to lead to new insights into the character of the explosion surface waves, so further progress can be made in understanding the physical effects that occasionally contaminate these data,

The feasibility evaluation of several of the non-seismic treaty verification methods is to be completed in FY 1983.

For the other techniques the FY 1983 program depends on the results of the feasibility evaluation in FY 1982. The next step for those techniques deemed feasible is engineering prototype development, or further evaluation on more extensive data sets for those techniques that use existing instrumentation. Additional efforts will be devoted to developing other non-seismic techniques for nuclear monitoring.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #NM-1/2
Program Element: #62714E
DoD Mission Area: 530

Title: Nuclear Monitoring
Title: Nuclear Monitoring
Budget Activity: 1. Technology Base

In FY 1984 most of the projects described in the previous paragraphs will be completed, or nearly so. The instrumentation focus will shift toward development of techniques to use advances in microelectronics to process the data in the field, rather than transmitting it to a central data collection facility. Evaluation of the ocean based seismic system will continue. If more systems are to be deployed, it will be necessary to develop techniques to do so with ships other than the GLOMAR CHALLENGER, and efforts to develop such techniques will be initiated. The development of an automated detection, location and event identification system is to be completed in FY 1984, with the system installed in the Seismic Data Center where it can operate on the digital data being managed at that center.

The analysis of results from small-scale chemical explosion experiments will be completed and used to test fundamental theories of the explosion source. There will unquestionably be many unresolved fundamental technical questions about explosion seismic waves, especially concerning source coupling, attenuation effects and surface wave generation. The importance of these unresolved questions for practical treaty verification capabilities will become more clear with further progress in the current program. Finally, increasing emphasis will be given in FY 1984 to the development of methods, both seismic and non-seismic, to counter complex methods to evade detection, especially in remote areas of the earth.

3. Program to Completion: The schedule for completion of this program is strongly dependent on international political developments. Possible changes to the Threshold Test Ban Treaty (ratification or revision) introduce new data and interpretation problems that require further research effort. Additional research will be needed to guide policymakers on the technical options to improve the verification of this treaty. Increased progress toward a Comprehensive Test Ban Treaty would require an intensified effort to improve capabilities to interpret data from in-country stations, and many important research problems cannot be fully formulated until the number and locations of the in-country stations are negotiated.

The key elements of the program beyond FY 1984 will include experimental validation of refined yield estimation procedures using new data from chemical and nuclear experiments. Also, it is anticipated that fundamental results in seismic source and propagation theory will be applied to reduce further the uncertainties in explosion yield estimation, as well as to improve identification methods. Counters to more complex evasion methods will be under

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #NM-1/2
 Program Element: #62714E
 DoD Mission Area: 530

Title: Nuclear Monitoring
 Title: Nuclear Monitoring
 Budget Activity: 1. Technology Base

development in the context of existing treaty developments. The Seismic Data Center will be available for test ban treaty research in support of international monitoring activities. Non-seismic monitoring techniques will be developed and transferred to the services for nuclear test monitoring, especially in remote areas of the globe.

A major requirement for work beyond FY 1984 will be for the development and evaluation of comprehensive signal detection and analysis techniques to provide options for future test ban negotiations. These techniques would combine data from current sensors with data from the advanced sensors under current development into a unified system for detection and identification of natural and nuclear events. New instrumentation requirements will be for a prototype multi-sensor monitoring station including on-site processing for recognizing signals and identifying their origin. Additional effort will also be placed on the development of the Marine Seismic System to make the deployment and operation flexible for possible use in remote ocean areas.

4. Milestones:

<u>*Last Year's Reported Plan</u>	<u>Current Plan</u>	<u>Milestones</u>	<u>Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries</u>
late FY 1982	late FY 1982	Develop Advanced Seismic Sensors	No Change.
late FY 1982	late FY 1982	Develop new seismic discrimination methods incorporating capability to exploit regional data.	Consolidation of three milestones.
late FY 1982	early FY 1983	Initial Prototype of Marine Seismic System Tests.	Drill ship schedule slippage.
--	mid FY 1983	Establish feasibility of satellite spectrometers for nuclear explosion and materials identification.	New Milestone.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #NM-1/2
 Program Element: #62714E
 DoD Mission Area: 530

Title: Nuclear Monitoring
 Title: Nuclear Monitoring
 Budget Activity: 1. Technology Base

*Last Year's Reported Plan	Current Plan	Milestones	Explanation of Changes from Milestones Reported in FY 1982 Descriptive Summaries
late FY 1983	late FY 1983	Complete development of Regional Discrimination and Identification Techniques.	No Change.
late FY 1983	late FY 1983	Develop Seismic Data Center to meet test ban data exchange obligations.	No Change.
--	late FY 1983	Complete feasibility tests on Neutrino Detector.	New Milestone.
--	early FY 1984	Complete development of automated event detection, location, identification system.	New Milestone.
late FY 1982	late FY 1984	Complete development of improved yield estimation procedures.	Scope Expanded.
late FY 1984	late FY 1984	Complete Evaluation of small-scale chemical explosion experimental results as a test of fundamental explosions source theory.	Consolidation of two milestones.
mid FY 1985	mid FY 1985	Complete development of counter-evasion methods for complex evasion techniques.	No Change.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #NM-1/2
 Program Element: #62714E
 DoD Mission Area: 530

Title: Nuclear Monitoring
 Title: Nuclear Monitoring
 Budget Activity: 1. Technology Base

5. Resources: (\$ in thousands)

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Nuclear Monitoring	\$15,068	\$ 16,800	\$ 17,300	\$ 22,500

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65898E
DoD Mission Area: 530

Title: Management Headquarters (R&D)
Budget Activity: 6. Defensewide Mission Support

A. RESOURCES: (\$ in Thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional To Completion</u>	<u>Total Estimated Costs</u>
TOTAL FOR PROGRAM ELEMENT		<u>7,077</u>	<u>7,776</u>	<u>8,100</u>	<u>8,200</u>	<u>Continuing</u>	<u>N/A</u>
MH-1	Program Management Support	7,077	7,776	8,100	8,200	Continuing	N/A

- B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides funds for payment of salaries to civilian employees and for administrative support costs of the Defense Advanced Research Projects Agency. This funding provides for the personnel compensation and benefits for civilians assigned to DARPA as well as costs for rent, travel, supplies and equipment, communications, printing and reproduction.
- C. BASIS FOR FY 1983 RDT&E REQUEST: Resources required for management and administration of the Defense Advanced Research Projects Agency. The higher funding in FY 1983 reflects increased personnel costs and increased costs of providing supplies, equipment, communications, travel, and rent for the Agency.
- D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The FY 1982 funding request is the same as in last year's FY 82 Descriptive Summary. The FY 1983 funding increase (\$24 Thousand) reflects increased personnel costs attributable to the October 1981 payraise.
- E. OTHER APPROPRIATION FUNDS: None.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MH-1
Program Element: #65898E
DoD Mission Area: 530

Title: Program Management Support
Title: Management Headquarters (R&D)
Budget Activity: 6. Defensewide Mission Support

- F. DETAILED BACKGROUND AND DESCRIPTION: This program element provides funds for normal management and support functions of the Defense Advanced Research Projects Agency. The funding includes civilian personnel compensation and benefits, and costs for rent, supplies, equipment, communications, printing and reproduction.
- G. RELATED ACTIVITIES: Not applicable.
- H. WORK PERFORMED BY: Civilian and military personnel assigned to the Defense Advanced Research Projects Agency.
- I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:
1. FY 1981 and Prior Accomplishments: In March, 1972, the Defense Advanced Research Projects Agency was established as a separate agency of the Department of Defense. Prior to that date, DARPA's personnel and support costs were largely included in the "Operations and Maintenance, Defense Agencies" appropriation. Since FY 1972, all of DARPA's personnel and administrative support costs have been funded within this program element.
 2. FY 1982 Program and FY 1983/FY 1984 Planned Programs: Funding under this program element in FY 1982 supports management and administration for the RDT&E program assigned to DARPA. The majority of the funds are required for the pay of personnel who operate the Agency. FY 1983 and FY 1984 funding provides for the continuation of the management and administrative support costs for DARPA. The program provides for the increased costs of providing supplies, equipment, communications, travel, and building rent for the Agency and includes funding for the October 1981 payraise.
 3. Program to Completion: Continuing.
 4. Milestones: Not applicable.
 5. Resources: (\$ in Thousands)

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #MH-1
 Program Element: #65898E
 DoD Mission Area: 530

Title: Program Management Support
 Title: Management Headquarters (R&D)
 Budget Activity: 6. Defensewide Mission Support

<u>Project Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Program Management Support	7,077	7,776	8,100	8,200

Research, Development, Test, and Evaluation, Defense Agencies

DCA

21 JAN 82

Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	3. Strategic programs	38,224	84,341	86,100	40,678	77,660	85,700
	4. Tactical programs		2,719	700		2,469	900
	5. Intelligence and communications	14,379	18,200	20,925	13,971	17,341	20,848
10.0001	Total	52,603	105,260	107,725	54,649	97,470	107,448
Financing:							
	Unobligated balance available, start of year:						
21.4001	For completion of prior year budget plans				-6,076	-3,974	-11,764
21.4002	Reprogramming from or to prior year budget plan	-56					
24.4001	Unobligated balance available, end of year				3,974	11,764	14,041
25.0001	Unobligated balance lapsing	56			56		
40.0001	Budget authority (appropriation)	52,603	105,260	107,725	52,603	105,260	107,725

Object Classification (in thousands of dollars)

Identification code	97-0400-0-1-051	1981 actual	1982 est.	1983 est.
Other services:				
125.003	Contracts	54,649	97,470	107,448
999.901	Total obligations	54,649	97,470	107,448

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DEFENSE COMMUNICATIONS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION
SUMMARY BY BUDGET ACTIVITY

(\$ in thousands)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
1. Technology base	-	-	-	-
2. Advanced technology development	-	-	-	-
3. Strategic programs	38,224	84,341	86,100	70,245
4. Tactical programs	-	2,719	700	746
5. Intelligence and communication	14,379	18,200	20,925	22,096
6. Defense-wide mission support	-	-	-	-
Total RDT&E - Direct	52,603	105,260	107,725	93,087
Reimbursements	-	-	-	-
Total Program	52,603	105,260	107,725	93,087

DEFENSE COMMUNICATIONS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION
SUMMARY BY PROGRAM CATEGORY

(\$ in thousands)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
6.1 Research	-	-	-	-
6.2 Exploratory Development	-	-	-	-
6.3 Advanced Development	789	1,166	1,262	1,400
6.4 Engineering Development	-	-	-	-
6.5 Management and Support	-	-	-	-
Total Research and Development (Program 6)	789	1,166	1,262	1,400
Total Operational Systems Program	51,814	104,094	106,463	91,787
Total RDT&E - Direct	52,603	105,260	107,725	93,087
Reimbursements	-	-	-	-
Total Program	52,603	105,260	107,725	93,087

Research, Development, Test, and Evaluation, Defense Agencies

DCA

21 JAN 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est
Program by activities:							
Direct:							
	3. Strategic programs				5,430		
	5. Intelligence and communications				590		
10.0001	Total				6,020		
Financing:							
	Unobligated balance available, start of year:						
21.4001	For completion of prior year budget plans				-6,076		
21.4002	Reprogramming from or to prior year budget plan	-56					
25.0001	Unobligated balance lapsing	56			56		
40.0001	Budget authority (appropriation)						

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est
Program by activities:							
Direct:							
	3. Strategic programs	38,224			35,248	2,976	
	5. Intelligence and communications	14,379			13,381	998	
10.0001	Total	52,603			48,629	3,974	
Financing:							
	Unobligated balance available, start of year					-3,974	
24.4001	Unobligated balance available, end of year				3,974		
40.0001	Budget authority (appropriation)	52,603			52,603		

Research, Development, Test, and Evaluation, Defense Agencies

DCA

21 JAN 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	3. Strategic programs		84,341			74,684	9,657
	4. Tactical programs		2,719			2,469	250
	5. Intelligence and communications		18,200			16,343	1,857
10.0001	Total		105,260			93,496	11,764
Financing:							
21.4001	Unobligated balance available, start of year						-11,764
24.4001	Unobligated balance available, end of year					11,764	
40.0001	Budget authority (appropriation)		105,260			105,260	

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	3. Strategic programs			86,100			76,043
	4. Tactical programs			700			650
	5. Intelligence and communications			20,925			18,991
10.0001	Total			107,725			95,684
Financing:							
24.4001	Unobligated balance available, end of year						12,041
40.0001	Budget authority (appropriation)			107,725			107,725

DEFENSE COMMUNICATIONS AGENCY
PERFORMER DISTRIBUTION
RESEARCH, DEVELOPMENT, TEST AND EVALUATION

(\$ in thousands)

Appropriation: <u>Research, Development, Test and Evaluation, Defense Agencies</u>	<u>Total Obligation Authority</u>			
	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
1. For operation of installations of the reporting DoD Component <u>Government</u> operated.	-	-	-	
2. For operation of installations of the reporting DoD Component <u>Contractor</u> operated.	-	-	-	
3. For contracts <u>directly in support</u> of work actually performed at installations of the reporting DoD Component	-	-	-	
4. For work assigned to other Department of Defense Agencies	12,098	42,393	39,958	29,281
5. For work assigned to activities of other Government agencies.	70	-	-	
6. For work performed by industrial contractors ("profit" organizations)	29,176	48,753	51,977	44,601
7. For work performed by educational institutions				
a. <u>Designated Federal Contract Research Centers.</u>				
b. <u>Other Institutions.</u>	25	95	-	
8. For work performed by other "non-profit" organizations				
a. <u>Designated Federal Contract Research Centers.</u>	11,234	14,019	15,790	19,200
b. <u>Other Institutions.</u>				
9. Total RDT&E appropriation	52,603	105,260	107,725	93,081

DEFENSE COMMUNICATIONS AGENCY
FEDERAL CONTRACT RESEARCH CENTERS

The summary of Federal Contract Research Centers (FCRCs) reflects a consolidation of funding requirements for the MITRE Corporation and the Institute of Defense Analysis (IDA). These organizations assist the Defense Communications Agency (DCA) in the planning, development and execution of DCA programs. The MITRE Corporation is relied upon extensively by DCA because of its unique expertise related to the planning, development, and execution of DCA programs, particularly in the vital Command and Control Communications area. MITRE's long involvement in these areas coupled with its eminently qualified staff results in an unparalleled quality of support. An important factor is MITRE's capability to provide in-depth fast responses. Another favorable factor contributing to objectivity is MITRE's freedom from bias due to absence of predilection for design, hardware or approach. The program increase from \$15,723,000 in FY 82 to \$18,860,000 in FY 83 is primarily for the high priority WWMCCS System Engineer Program, the Defense Communications System (DCS) Satellite System, WWMCCS Strategic Connectivity, Command Information System (CIS), Joint Reporting Structure Modernization, survivability/endurability enhancements and escalation costs.

IDA's excellent working knowledge of military communications systems, organizations, and operating procedures, coupled with an effective working relationship with the Department of Defense, has resulted in excellent analysis support to DCA. The thrust of the work planned for IDA in FYs 82-83 will be directed toward the development of a survivable system architecture for the WWMCCS and the definition of potential improvement for both Strategic and Theater/Tactical Command, Control and Communications.

The following summary identifies the estimated value of work to be performed by FCRCs in FY 83-84.

FEDERAL CONTRACT RESEARCH CENTERS
DEFENSE COMMUNICATIONS AGENCY
SUMMARY BY APPROPRIATION/PROGRAM ELEMENT
(\$ in Thousands)

	FY 1981 <u>Actual</u>	FY 1982 <u>Estimate</u>	FY 1983 <u>Estimate</u>	FY 1984 <u>Estimate</u>
<u>MITRE Corporation</u>				
<u> RDT&E</u>				
32016K National Military Command System-wide Support	2,751	1,971	2,095	2,834
32017K WWMCCS ADP-JTSA	275	1,400	1,695	1,400
32019K WWMCCS System Engineering	5,517	5,083	6,070	7,973
33126K Long-Haul Communications DCS	1,098	1,300	660	720
33131K Minimum Essential Emergency Communications Network	1,373	3,100	4,070	4,973
33152K WWMCCS Information System	-	540	-	-
TOTAL RDT&E	<u>11,014</u>	<u>13,394</u>	<u>14,590</u>	<u>17,900</u>
<u> O&M</u>				
32016K National Military Command System-wide Support	1,549	1,429	1,490	1,666
32019K WWMCCS System Engineering	-	-	600	700
33126K Long-Haul Communications DCS	-	300	1,080	1,200
33127K Support to NCS	-	600	990	1,200
33131K Minimum Essential Emergency Communications Network	-	-	110	134
TOTAL O&M	<u>1,549</u>	<u>2,329</u>	<u>4,270</u>	<u>4,900</u>
Total MITRE CORPORATION	<u>12,563</u>	<u>15,723</u>	<u>18,860</u>	<u>22,800</u>
<u>INSTITUTE FOR DEFENSE ANALYSIS</u>				
<u> RDT&E</u>				
32019K WWMCCS System Engineering	220	625	1,200	1,300
<u>TOTAL PROGRAM BY APPROPRIATION</u>				
<u> RDT&E</u>				
	11,234	14,019	15,790	19,200
<u> O&M</u>				
	<u>1,549</u>	<u>2,329</u>	<u>4,270</u>	<u>4,900</u>
TOTAL FCRC, DEFENSE COMMUNICATIONS AGENCY	<u>12,783</u>	<u>16,348</u>	<u>20,060</u>	<u>24,100</u>

DEFENSE COMMUNICATIONS AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION
DETAILS BY BUDGET ACTIVITY
(\$ in thousands)

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Summary Page No.
<u>Budget Activity 3. Strategic Programs</u>					
<u>Program 6.3 Advanced Development</u>					
63735K Worldwide Military Command & Control System (WWMCCS)					
Architecture	789	1,166	1,262	1,400	306
Subtotal Program 6.3	789	1,166	1,262	1,400	
<u>Operational Systems Program</u>					
32016K National Military Command System-Wide Support	5,284	9,278	7,906	8,570	307
32017K Worldwide Military Command & Control System (WWMCCS)					
ADP-JTSA	5,787	14,261	23,355	19,955	311
32019K WWMCCS System Engineer	22,774	49,269	43,732	29,327	325
33131K Minimum Essential Emergency Communications Network	3,590	6,483	9,845	10,993	335
33152K WWMCCS Information System	-	3,884	-	-	341
Subtotal Operational Systems Program	37,435	83,175	84,838	68,845	
Total Budget Activity 3	38,224	84,341	86,100	70,245	
<u>Budget Activity 4. Theater and Tactical C3I</u>					
<u>Operational Systems Program</u>					
21135K CINC Command & Control Initiatives	-	2,719	700	746	344
Subtotal Operational Systems Program	-	2,719	700	746	
Total Budget Activity 4	-	2,719	700	746	
<u>Budget Activity 5. Intelligence and Communications</u>					
<u>Operational Systems Program</u>					
33126K Long-Haul Communications (DCS)	14,379	18,200	18,935	19,136	347
33127K Support of NCS	-	-	1,990	2,960	360
Subtotal Operational Systems Program	14,379	18,200	20,925	22,096	
Total Budget Activity 5	14,379	18,200	20,925	22,096	
TOTAL RDT&E PROGRAM	52,603	105,260	107,725	93,087	

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element #63735K
 DoD Mission Area: Strategic C2 - #331

Title: WWMCCS Architecture
 Budget Activity: #3 Strategic Programs

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	789	1,166	1,262	1,400	Continuing	Continuing
3900	WWMCCS Architecture Support	789	1,166	1,262	1,400	Continuing	Continuing

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED This project provides funding for the continuation of the WWMCCS Architecture Program initiated in 1974. The architecture effort as set forth in the Deputy Secretary of Defense Memorandum of 24 June 1976 directed the: (1) continual evaluation of the current and developmental capabilities of the WWMCCS to support the National Command Authorities and Unified and Specified Commands in an environment of evolving policy, force structure, threat and technology (2) identification of developing insufficiencies and imbalances in WWMCCS capabilities and those of the supporting system; (3) development of alternatives for architectural improvements and related major issues for consideration by the WWMCCS Council; and (4) development of architectural revisions as directed by the WWMCCS Council. This capability is essential as an evaluation procedure and provides an overall architectural frame of reference which serves as a basis for identifying needs which can be translated into programs by the system engineering process.

C. BASIS FOR FY 1983 RDT&E REQUEST: The WWMCCS architecture project is required to provide a continuing overview of the characteristics of command and control (C2) systems in view of changes in the environment, threat, force structure, technology and U.S. Defense policy and to recommend conceptual system improvements/modifications in response to those changes. The FY 1983 request will provide an assessment of current C² systems capabilities for the orderly transition to recommended long range capabilities, continue the development of a long-term end to end strategic connectivity architecture for improved C² general and protracted nuclear war capabilities, and allow the evaluation of strategic defense C³ in the areas of space defense, tactical warning/attack assessment, air defense and anti-ballistic missile defense.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: This project is a continuing level of effort for the architectural developments and revisions necessary to ensure the systematic and orderly evolution of command and control systems.

E. OTHER APPROPRIATION FUNDS: None

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 32016K
DoD Mission Area: Strategic Command and Control #331

Title: NMCS-Wide Support
Budget Activity: Strategic Programs #3

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Cost
2621	Systems	881	1706	1628	793	Continuing	N/A
2623	ANMCC Engineering	0	345	608	514	Continuing	N/A
2624	NEACP Engineering	978	1458	1413	1812	Continuing	N/A
2625	WWMCCS/NMCS Exercise and Evaluation	301	154	104	454	Continuing	N/A
2626	NMCS Communications Subsystem Eng.	677	657	591	711	Continuing	N/A
2627	NMCS Warning Subsystem Engineering	429	1184	1481	1601	Continuing	N/A
2628	NMCS DC&P Subsystem Engineering	587	746	2081	2685	Continuing	N/A
2629	User Automated Message Handling Sys.	1138	3028	0	0		
2630	Strategic Connectivity Engineering	293	0	0	0		
TOTAL FOR PROGRAM ELEMENT		5284	9278	7906	8570		

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides system engineering and technical support to the National Military Command System (NMCS), the priority component of the Worldwide Military Command and Control System (WWMCCS), designed to meet the command and control requirements of the National Command Authorities (NCA) and the Joint Chiefs of Staff (JCS). The NMCS provides the NCA with information concerning military posture, readiness, and activities in all environments from normal day-to-day operations to nuclear war and crisis management situations.

C. BASIS FOR FY 1983 RDT&E REQUEST: This program element is composed of seven projects. Systems provides the basic overall systems engineering support for the development and integration of NMCS system requirements, studies, and analysis and for planning and programming evolutionary improvements for the NMCS. Alternate National Military Command Center (ANMCC) Engineering supports the system engineering responsibilities of the Defense Communications Agency (DCA), Command and Control Technical Center (CCTC) for the ANMCC. National Emergency Airborne Command Post (NEACP) Engineering develops concepts and requirements and provides subsystems engineering support to the Advanced Airborne Command Post (AABNCP) program and the NEACP in the areas of NEACP Communications Interface Enhancements and NEACP Configuration Control. WWMCCS/NMCS Exercise and Evaluation supports OCS

Program Element: 32016K
DoD Mission Area: Strategic Command and Control #331

Title: NMCS-Wide Support
Budget Activity: Strategic Programs #3

exercises, testing of WWMCCS/NMCS functional processes, command post training exercises, and special studies directed at providing performance and evaluation data about the NMCS and selected portions of the WWMCCS. NMCS Communications Subsystem Engineering provides the analysis, development, engineering, and implementation of programs to enhance the communications capability of the NMCS. NMCS Warning Subsystem Engineering provides system engineering, design, and development support necessary to improve the flow of Tactical Warning and Attack Assessment (TW/AA) information to high level decision makers. NMCS Data Collection and Processing (DC&P) Subsystem Engineering provides for the near-term systematic development of military reporting procedures and systems. Effective in FY83, User Automated Message Handling System (UAMHS) and Strategic Connectivity Engineering (SCE) projects are moved to program elements 32017K and 33131K, respectively.

D. COMPARISON WITH FY82 DESCRIPTIVE SUMMARY: This PE shows a net decrease of \$75,000 from FY82 to FY83 due to a restructuring of priorities.

E. OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
Operations and Maintenance	4071	5403	5047	4995

Project: 2628
Program Element: 32016K
DoD Mission Area: Strategic Command and Control #331

Title: NMCS DC&P Subsystem Engineering
Title: NMCS-Wide Support
Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: Provides system engineering support for systematic development and implementation of NMCS Data Collection and Processing subsystems in order to satisfy JCS C³ operational needs. This project is composed of four major tasks. The Concepts and Requirements task manages NMCS information systems. The WIS Modernization Engineering task seeks to ensure the smooth transition between the WIS modernization and the NMCS Information and Display System and JCS applications on the Honeywell computers. The JRS Modernization task seeks to improve the methods of collecting, processing and distributing data through the Joint Reporting Structure (JRS) in order to make the JRS more reliable and responsive. The NEACP ADP task supports the development of an automatic information handling capability onboard the National Emergency Airborne Command Post (NEACP).

G. RELATED ACTIVITIES: The impact of WIS modernization on NMCS ADP systems will result in close liaison with the Joint Program Manager for WIS. The program to place ADP on-board the NEACP will continue to be a joint effort involving OJCS, the Air Force and DCA/CCTC.

H. WORK PERFORMED BY: MITRE, TRW, and BDM.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

Developed advanced concepts for new NMCS information systems and conducted analyses and development for NEACP ADP, a Command Center Automated Retrieval and Display System (CARDS), and the JRS.

2. FY 1982 Program:

The WWMCCS Information System baseline software specification will be factored into current NMCS documentation. A concept of operation will be developed for a wartime reporting system. In the area of Enhanced General War System (EGWS), an ADP concept of operations will be developed and an engineering analysis of security issues will be conducted with respect to EGWS data communications.

Project: 2628
Program Element: 32016K
DoD Mission Area: Strategic Command and Control #331

Title: NMCS DC&P Subsystem Engineering
Title: NMCS-Wide Support
Budget Activity: Strategic Programs #3

3. FY 1983 Planned Program:

Requirements will be established for local networking within the NMCS. Multi-level security programs will be addressed in concert with these requirements. The increase in spending levels from FY82 to FY83 resulted from the JCS's desire to streamline and revise the JRS. This additional tasking will develop a modernization plan to convert all reporting systems within the JRS and will actually convert and test procedures and computer software for one of the major reporting systems. ADP and communications requirements will be developed for a NEACP operational capability. All automated command system functions will be examined to assess the feasibility of transferring these functions from the Honeywell computer.

4. FY 1984 Planned Program:

The future implementation of multi-level security for local networking within NMCS will be reflected in engineering design documents. The conversion of current reporting systems will continue as delineated in the JRS modernization plan. Improvements will be made to the ADP capability on the NEACP as a result of new requirements, and improvements in communication and ADP technology.

5. Program to Completion:

This is a continuing project.

6. FY83 Milestones:

- o Revise and update J3I 3000.10A (instruction delineating ADP requirements for the NMCS).
- o Perform test and evaluation of an NEACP ADP Initial Operation Capability.
- o Publish requirements for local networking security under WIS.
- o Develop and publish JRS Modernization Plan.

7. Resources: (\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
310	587	746	2081	2685

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 32017K
DoD Mission Area: Strategic Information Systems #334

Title: WWMCCS ADP -JTSA
Budget Activity: Strategic Programs #3

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Cost
2777	Systems Research and Engineering	5787	3913	2819	3094	Continuing	N/A
2778	WIS Transition Support	0	569	11276	6868	Continuing	N/A
2779	R&D in New WWMCCS ADP Applications	0	7438	6302	7251	Continuing	N/A
2780	Advanced Concepts	0	2341	2958	2742	Continuing	N/A
TOTAL FOR PROGRAM ELEMENT		5787	14261	23355	19955		

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides technical assistance to the Joint Chiefs of Staff, Military Departments, Agencies, NATO, Air Force MAJCOMS, and Unified/Specified Commands for Standard ADP systems supporting the Worldwide Military Command and Control System (WWMCCS). Included are development/maintenance of an integrated ADP command and control system and continued technological improvement of reliability, survivability, and responsiveness of the system. The program contains four projects, each addressing a major thrust. The first thrust is to develop and improve upon the existing integrated ADP system that supports the command and control functions of the National Command Authorities and WWMCCS commanders in the near term (Systems Research and Engineering project). The second program thrust is to provide a wide range of technical support to the WWMCCS Information System (WIS) Joint Program Manager. The third thrust is to identify and demonstrate ways to improve ADP support in the performance of WWMCCS functions during crisis (R&D in New Applications project). The final program thrust is to provide a wide range of technical assistance to support the modernization/transition of WWMCCS ADP from the current baseline to a DoD- defined enhanced capability in the 1988 timeframe (Advanced Concepts project).

C. BASIS FOR FY 1983 RDT&E REQUEST: Funding for FY 1983 must continue to support improvement in the operation of WWMCCS ADP in an increasingly complex role, while at the same time, preparing to support the modernized WWMCCS Information System (WIS). Previously developed enhancements to the WWMCCS Intercomputer Network (WIN) will transition to operational status. Design specification development of the Command Information Subsystem (CIS) will be completed and competitive development contracts will be awarded. Improvements in ADP support in the performance of major WWMCCS functions will be demonstrated. The approximate doubling of the program total in FY 1983 reflects increased funding to support the Command Information Subsystem (CIS) task within

Program Element: 32017K
DoD Mission Area: Strategic Information Systems #334

Title: WWMCCS ADP -JTSA
Budget Activity: Strategic Programs #3

the WIS Transition Support project. This increase is a result of: (a) a greatly expanded CIS effort during FY 1983, and (b) a transfer of substantial P.E. 32016K funding to the CIS effort in FY 1983.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The Advanced Technology project from the FY 1982 Descriptive Summary has been integrated with the WIS Transition Support project. This project was also augmented to include the User Automated Message Handling System (UAMHS) project from P.E. 32016K, project 2629. A new project, Advanced Concepts, brings together a number of tasks to examine state-of-the-art technology applications to the WWMCCS environment and the WIS modernization effort. The Systems Research and Engineering project reflects a gradually diminishing role for the existing WWMCCS standard system baseline in favor of modernized systems in the out years. The entire program element is now closely focused upon furthering the objectives of the WIS Modernization.

E. OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
Procurement	0	0	0	3700
Operation and Maintenance	0	0	0	0

Project: 2777

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: Systems Research and Engineering

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: This project will develop new and improved capabilities for WWMCCS which are predominately hardware independent and can be readily transitioned to support the WWMCCS Information System (WIS). This effort will implement changes in WWMCCS ADP software by performing the necessary analysis to integrate previously available features with required new capabilities. Emphasis will be placed on the application of existing and emerging technology to provide improvements in such areas as security, performance, and reliability. In particular, the project will design and implement the WWMCCS Network Front End (WNFE) Program. Additionally, the project will exploit emerging and existing state-of-the-art technology with an intent to provide more effective ADP system interfaces for command and control users.

G. RELATED ACTIVITIES: This project will emphasize hardware and software independent capabilities which support the WIS transition or can be readily transitioned to the WIS. The project is generally concerned with enhancement of the WWMCCS ADP baseline which may effect the WIS architecture and implementation.

H. WORK PERFORMED BY: MITRE, Digital Technology Incorporated, Computer Sciences Corporation, TRW, Honeywell Information Systems, Incorporated, and System Development Corporation.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

In the area of computer netting, efforts under this project developed the Prototype WWMCCS Intercomputer Network (PWIN), the successor WWMCCS Intercomputer Network (WIN), and early versions of intercomputer network front ends like the Experimental Network Front End (ENFE) and the Interim Network Front End (INFE). Accomplishments in the area of computer graphics include establishment of a three-phased standard graphics program that has already produced a standard graphics terminal capability, and is undertaking development of a fully functional remote graphics capability. Accomplishments in other areas include development of an improved interface to the WWMCCS Data Management System, technical support for the definition, design, and development of specialized secure operating systems, and the development of a prototype local area network based upon data bus technology.

2. FY 1982 Program:

Planning will be initiated for a potential major transition of WWMCCS software to an entirely new operating system and associated software. Development of enhancements to the WIN will continue. Testing will continue on a hardware prototype of the WWMCCS NFE. Prototype design and development of a distributed data access capability will begin. Exploitation of network performance evaluation models to aid in WIN design will begin. Integration analysis of the impact of the emerging WIS architecture on the existing WWMCCS ADP baseline will continue.

Project: 2777

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: Systems Research and Engineering

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

3. FY 1983 Planned Program:

To determine the optimal approach to WWMCCS software development, a follow-on analysis of entirely new operating system and associated software and the WIS (WWMCCS Information System) architecture will be accomplished. Enhancements to WIN WWMCCS Intercomputer Network) reliability and resiliency will transition to operational status. Development of a WIN site back-up capability and distributed data base processing techniques will continue. Testing and evaluation of the WWMCCS NFE (Network Front End) will be completed and an initial version distributed to the WWMCCS ADP sites. Procedures will be developed to test and evaluate promising new software products which are candidates for the standard WWMCCS ADP system. All development and experimentation will consider the impact of WIS. Analysis of the impact of WIS architecture upon all WWMCCS ADP will continue.

4. FY 1984 Planned Program:

Efforts will continue to analyze the impact of future WIS architecture on WWMCCS ADP. Testing and evaluation of the WWMCCS NFE/AUTODIN II interface will continue. Development and evaluation necessary to support enhanced intercomputer networking requirements will continue. Additional efforts will focus on upgrading network capabilities through experimentation carried out on the WIS Integration and Test Facility.

5. Program to Completion:

The ADP field is constantly changing due to continuing advancements in technology. The Systems Research and Engineering project is thus planned to continue into the future to incorporate technological advancements into the WWMCCS ADP System to better satisfy user requirements. All work will be consistent with the emerging WIS architecture.

6. Milestones:

- o Distribute initial version of WWMCCS NFE to the sites - FY83.
- o Analyze specified WWMCCS software and identify WIS transition requirements - FY83.
- o Develop and evaluate new capabilities for host computer network functions - FY83-84.
- o Undertake network performance evaluation analyses - FY82-84.
- 314 o Provide WIN reliability and resiliency enhancements to the sites - FY82-84.

Project: 2777

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: Systems Research and Engineering

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

7. Resources: (\$ in Thousands)

<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
5787	3913	2819	3094

Project: 2778
Program Element: 32017K
DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: WIS Transition Support
Title: WWMCCS ADP - JTSA
Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: This project provides technical support to the WWMCCS Information System (WIS) Program Manager. The support will include transition planning, preparation of WIS design specifications, development of the Command Information Subsystem (CIS), and development of an integration and test capability to conduct WIS acceptance testing. The CIS work will provide necessary systems engineering and program management for the development of an automated and standardized message handling system to be installed in all operations centers of the WWMCCS including the NMCS. This capability, referred to as the Automated Message Handling System (AMHS), is one of the WWMCCS selected architecture programs and was tasked to the DCA for further development by SecDef in FY79. This system will provide WIS user interface, message handling and formatting, and local message transmission control. The AMHS effort will concentrate on developing and evaluating benchmark requirements, completing system design and interface documentation, and evaluating R&D opportunities for inclusion in the AMHS design as part of the WIS. Additionally, a WIS Integration and Test Facility will be developed in order to provide a hardware, software, and telecommunications vehicle to test local networking. The Command Information Subsystem and appropriate other WIS functions prior to implementation.

G. RELATED ACTIVITIES: This project provides direct technical support to the WIS Program Manager in the development and implementation of the WIS modernization program. As such, it is directly related to the activities being performed in the Systems Research and Engineering and Advanced Concepts projects within P.E. 32017K.

H. WORK PERFORMED BY: MITRE, TRW, Digital Technology Incorporated, and Computer Sciences Corporation.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

This project represents a new start in FY82. Previous activity in this area was performed under the WIS Acquisition Technical Support and Advanced Technology projects. Under these earlier projects, upgrade options proposed by the present WWMCCS mainframe vendor were evaluated and the results coordinated with the WWMCCS System Engineer for consideration in defining WIS architectural alternatives for the WWMCCS Council. In addition, initial development work was performed for the Automated Message Handling System (AMHS).

2. FY 1982 Program:

316

During FY82, the Request for Proposal (RFP) for the CIS Design is scheduled to be released, proposals reviewed, and three competing design contractors selected to begin work. A Technical Analysis/Cost Estimate and Management Engineering Plan for CIS will be developed. Work will continue on development of an Independent Verification and Validation (IV&V) program. Analysis of requirements to define WIS capabilities, interfaces, and standards is scheduled to begin. The preparation of a WIS

Project: 2778
Program Element: 32017K
DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: WIS Transition Support
Title: WWMCCS ADP - JTSA
Budget Activity: Strategic Programs #3

Management Engineering Plan and identification of baseline specifications suitable for competitive acquisition and software development are also scheduled to be initiated. Initial preparation of specifications for WIS standard hardware, telecommunications, and user interface devices will begin. Emerging concepts such as load sharing, distributed data processing, and data base management will be analyzed for potential application to WIS.

3. FY 1983 Planned Program:

CIS efforts will continue to monitor and evaluate the three competing design contractors and later, to assist in the selection of the two "winning" development contractors. This selection assistance will consist of preparation of the Request for Proposal/Statement of Work, and planning for Operational Test and Evaluation. A CIS Independent Verification and Validation (IV&V) effort will be conducted in a similar manner to the CIS design/development effort. Funding for three IV&V design contractors for nine months will be provided, and an IV&V plan for the two "winning" development contractors will be created. Preparation of specifications for WIS acquisition and software development will continue. In addition, initial WIS transition procedures will be developed. Work will continue on the preparation of a WIS Management Engineering Plan. Based upon an approved set of specifications, the procedures necessary for acquisition of hardware, software, and communications equipment for the WIS Integration and Test Facility is scheduled to begin. There will be a substantial increase in funding for this project in FY83 since monies from P.E. 32016K were transferred to P.E. 32017K for CIS work.

4. FY 1984 Planned Program:

CIS efforts will include procurement of initial hardware and development support for the WIS Integration and Test Facility. In addition, monitoring of the two CIS development contractors will continue and design and/or development enhancement support will be provided. Development of WIS transition procedures will continue. The actual acquisition and installation of hardware, software, and communications equipment for the WIS Integration and Test Facility will be accomplished. The preparation of acceptance criteria and specifications for WIS standard hardware, telecommunications, and user interface devices will begin.

5. Program to Completion:

Evolving operational requirements will be analyzed for impact upon the WIS and the WIS transition. During this period, the WIS Integration and Test Facility will be in operation. Hardware/software will be evaluated to ensure that it is compatible with the latest WIS architecture. Hardware and software procurements will be initiated for the test facility as required. Results of software engineering and development will be evaluated and utilized to assist in the conversion of software and data

Project: 2778

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: WIS Transition Support

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

to the selected WIS architecture. Accepted/approved WIS system(s) will be deployed to the operational community. CIS efforts will continue to provide necessary funding for the procurement of additional hardware for functional test and evaluation. The CIS efforts will also continue to provide support to Command Center officers and other staff action officers as required.

6. Milestones:

- o CIS design - FY82-83.
- o CIS development - FY83-85.
- o WIS Management Engineering Plan - FY83.
- o Specifications for WIS standard hardware, telecommunications, and user interface devices acquisition - FY83.
- o WIS Transition procedures - FY83.
- o Implementation of the WIS Integration and Test Facility - FY84-85.

7. Resources: (\$ in Thousands)

<u>FY81</u> <u>Actual</u>	<u>FY82</u> <u>Estimate</u>	<u>FY83</u> <u>Estimate</u>	<u>FY84</u> <u>Estimate</u>
0	569	11276	6868

Project: 2779

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: R&D in New WWMCCS ADP Applications

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: This project started as the Operational Utility of WWMCCS ADP. Originally, experiments were designed to identify a set of improvements which would increase the operational utility of WWMCCS ADP. Following Congressional review, this project was redirected to provide extensive user involvement, and to identify and demonstrate ways to improve ADP support in the performance of WWMCCS functions during crisis. Accordingly, candidate ADP applications are being designed, and will be implemented, demonstrated, and evaluated for their impact on the WWMCCS and their acceptability to WWMCCS operational users. The authority for this project derived from enclosure 9 to DepSecDef Memorandum, "WWMCCS Architectural Plan," 24 June 1976. The program was reconfirmed by DepSecDef Memorandum, same subject, 24 April 1978. Program objectives were expanded by ASD (C³I) Memorandum, "WWMCCS Architectural Plan - Research and Development in the Operational Utility of Automatic Data Processing," 3 February 1978, and further modified by ASD (C³I) Memorandum, "WWMCCS Information System Modernization Plan," 3 July 1979. This project consists of six tasks as follows: Systems Engineering and Technical Assistance; Independent Verification and Validation/Test and Evaluation; and four prototype ADP applications. These four prototype applications are:

1. Logistics Network (LOGNET). LOGNET is a logistics integration application with the Army to improve unit shortfall identification, and unit sustaining resource requirements during crisis deployments.
2. CINCLANT/CCCJTF Command and Control Interface (CINCLANT/CCCJTF). CINCLANT/CCCJTF is an information exchange application with CINCLANT and the Commander, Caribbean Command (formerly Caribbean Contingency Joint Task Force) to demonstrate improvements in situation assessment and the development and coordination of OPPLANS between geographically separated decision makers via interactive graphics conferencing.
3. Transportation Coordinator Automated Command and Control Information System (TC ACCIS). TC ACCIS is an application to improve crisis deployment execution by automating unit movement requirements identification at the source and TC functions at corresponding installation transportation offices.
4. Marine Corps Unit Identification Support (USMC UIDS). USMC UIDS is an application to speed up the process of identifying specific forces, unit shortfall identification and resolution, and resulting movement requirements in support of the Rapid Deployment Joint Task Force (RDJTF) in particular and crisis action planning in general.

G. RELATED ACTIVITIES: (None)

H. WORK PERFORMED BY: The work in FY82 is being performed by the Defense Communications Agency supported by MITRE, TRW, Computer Sciences Corporation, and Systems Development Corporation.

Project: 2779

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: R&D in New WWMCCS ADP Applications

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

Two preliminary demonstrations were conducted early in FY 1981 to validate the LOGNET and CINCLANT/CCCJTF application concepts. Functional descriptions were developed for and work started on the system specification for LOGNET and CINCLANT/CCCJTF. Application Descriptions were approved and work started on the functional descriptions for the TC ACCIS and USMC UIDS applications.

2. FY 1982 Program:

Continue system development and procure the hardware for four ADP applications (LOGNET, CINCLANT/CCCJTF, TC ACCIS, and USMC UIDS). Continue analysis leading to definition of ADP applications for future program implementation.

3. FY 1983 Planned Program:

Complete system development and begin Government acceptance testing for the LOGNET application. Continue system development for three ADP applications (CINCLANT/CCCJTF, TC ACCIS, and USMC UIDS). Continue analysis leading to definition of ADP applications for future program implementation.

4. FY 1984 PLANNED PROGRAM:

Operational evaluation of the LOGNET and CINCLANT/CCCJTF prototype ADP applications will be conducted and the prototypes turned over to the Army and CINCLANT, respectively, as a basis for operational implementation. Complete system development and begin Government acceptance testing for the TC ACCIS and UIDS applications. Continue analysis leading to definition of ADP applications for future program implementation.

5. Program to Completion:

32C

Operational evaluation of the TC ACCIS and USMC UIDS prototype ADP applications will be conducted and the prototypes turned over to the Services and Marine Corps, respectively, as a basis for operational implementation. Since the R&D in New WWMCCS ADP Applications Program is a continuing research and development program, future ADP applications which are focused on WWMCCS user problems will be identified, designed, developed, demonstrated, and evaluated as to their effectiveness and user acceptability to enhance WWMCCS crisis support and to influence the continuing WWMCCS Information System modernization effort.

Project: 2779

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: R&D in New WWMCCS ADP Applications

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

6. Milestones - FY 1983:

- a. LOGNET: Complete software development and begin Government acceptance testing.
- b. CINCLANT/CCCJTF: Complete software development and begin Government acceptance testing.
- c. TC AUTO C2 INFO: Complete system design and begin software development.
- d. USMC UIDS: Complete system design.

7. Resources: (\$ in Thousands)

<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimated</u>	<u>FY 1983</u> <u>Estimated</u>	<u>FY 1984</u> <u>Estimated</u>
0	7438 ¹	6302 ²	7251

Note: 1. An additional 1,100,000 will be provided by Army.

2. An additional 1,300,000 will be provided by Army.

Project: 2780

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: Advanced Concepts

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: The Department of Defense (DoD) has developed a comprehensive plan for the modernization of the WWMCCS ADP. That plan, the Modernization of the WWMCCS Information System (WIS), 19 January 1981, calls for a phased modernization of WWMCCS ADP. To support this plan, this project will provide a sound technical basis for an orderly transition/modernization of WWMCCS ADP from the current baseline to a specified "Phase III" capability in the FY88 timeframe and will be carried out under the aegis of the WIS JPMO. The project will undertake the design and implementation of a high performance secure communications operating system for the WWMCCS Network Front End device. Experimentation with high capacity local area network technology will include those efforts necessary to exploit this new technology as it directly applies to WWMCCS ADP and its transition to new generations of hardware and software. The experiments performed will be directed toward an operational capability in the 1985 to 1988 timeframe. This project will develop software and hardware technologies for the transition of existing WWMCCS ADP systems to operational environments established by AUTODIN II and the WIS architecture. The project will include development of new capabilities in the area of computer performance evaluation. Finally, the project will provide more effective man-machine interfaces for command and control users through exploitation of intelligent terminals and computer graphics.

G. RELATED ACTIVITIES: This project provides WWMCCS users with state-of-the-art ADP technology that will allow new capabilities to be implemented as part of the WIS modernization program. It is related to the Systems Research and Engineering and WIS Transition Support projects. It supports the R&D in New Applications project in that it provides the enhanced hardware and software baseline systems upon which the new applications software can be tested and evaluated.

H. WORK PERFORMED BY: MITRE, Digital Technology Incorporated, System Development Corporation, Computer Sciences Corporation, and Honeywell Information Systems, Incorporated.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

Prior to FY82, this work was accomplished under the following specific tasks within the Standard System Software Development and Enhancement project: Secure Communications Operating System (COS/FE), Graphics, Computer Performance Evaluation, and Local Networks. Beginning in FY82, the Advanced Concepts project was initiated to properly focus efforts on applications of forward-oriented technology with respect to WIS modernization.

2. FY 1982 Program:

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During FY82, development and experimentation directed at providing a set of local area networking capabilities necessary

Project: 2780
Program Element: 32017K
DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: Advanced Concepts
Title: WWMCCS ADP - JTSA
Budget Activity: Strategic Programs #3

to support the transition of WWMCCS ADP to the new WIS architecture in the mid 1980s will be performed. Initial components for a prototype local net test-bed to support existing terminals and word processing systems at CCTC, Reston will be acquired and installed as part of the WIS Integration and Test Facility. Security requirements and related issues will be identified and analyzed. Development of color graphics capability for the WWMCCS standard graphics terminal will begin. In addition, work will continue to develop the high performance, multi-level secure Communications Operating System/Front End (COS/FE). Evaluation and performance measurement of Communications Operating System Network Front End (COS/NFE) will be initiated and documentation of the prototype system will be finalized. System integration and testing of the prototype software will be conducted and a security analysis of prototype software performed. Expansion of current computer performance evaluation capability to network front-end and terminal equipment will be initiated.

3. FY 1983 Planned Program:

During FY83, the test-bed will be further expanded to accommodate additional support center functions and continue experiments begun in FY82. In addition, a functional requirements document for networking capabilities based on synthesis of WIS studies and prior local networking experiments will be developed. Hardware specifications and/or approved equipment lists for user acquisition of components will be developed. Evaluation and performance measurement of the COS/NFE system will continue and the security analysis of prototype software will be completed. Work will continue on the development of tools for collection, analysis and reporting of network front-end performance data. Research will be conducted to obtain performance evaluation data on a virtual memory system. Development of specifications and subsequent acquisition of a prototype color hard copy graphics system will be completed.

4. FY 1984 Planned Program:

During FY84, it is planned to continue local network experiments and enhancements based on current WIS transition requirements and available technology, and to develop hardware specifications and approved equipment lists for acquisition by WWMCCS users. The evaluation, performance measurement, and timing of the COS/NFE system will be continued and the COS/NFE software will be enhanced. Computer performance evaluation and graphics tools previously developed will be fielded. Performance evaluation of large scale local network systems will begin.

5. Program to Completion:

The implementation, testing, and evaluation of local network software will be completed and the software will be installed at selected WWMCCS test sites. Experiments and enhancements will continue, and they will serve as a basis for subsequent releases which will be developed during FY86, to incorporate changes based on experience with the initial release and evolving requirements. The multi-level security properties of the converted COS/NFE will be verified and the transition to Phase II NFE program will be performed. Research in methods of evaluating large scale local networks will continue.

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Project: 2780

Program Element: 32017K

DoD Mission Area: #31 DoD-Wide Intel. and Comm. #334

Title: Advanced Concepts

Title: WWMCCS ADP - JTSA

Budget Activity: Strategic Programs #3

6. Milestones:

- o Installation of initial components for the local network test-bed - FY82.
- o Functional requirements documentation for local network capabilities - FY82.
- o COS/NFE prototype software - FY83.
- o Hardware specifications for acquisition of local network components - FY84.
- o Local network software releases - FY84.

7. Resources: (\$ in Thousands)

<u>FY81</u> <u>Actual</u>	<u>FY82</u> <u>Estimate</u>	<u>FY83</u> <u>Estimate</u>	<u>FY84</u> <u>Estimate</u>
0	2341	2958	2742

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element #32019K

DoD Mission Area: Strategic C2 - #331

Title: WWMCCS System Engineering

Budget Activity: #3 Strategic Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	22,774	49,269	43,732	29,327	Continuing	Continuing
2910	WWMCCS Near/Mid Term Engineering	-0-	1,848	2,998	2,893	Continuing	Continuing
2950	Enhanced Post-Attack WWMCCS Capabilities	14,033	29,439	28,076	14,712	Continuing	Continuing
3310	WWMCCS System Engineering	4,098	7,792	11,658	11,222	Continuing	Continuing
3350	Post-Attack Architecture	-0-	1,650	1,000	500	Continuing	Continuing
3380	Next Generation WWMCCS ADP	4,643	8,540	0	0	0	

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the Worldwide Military Command and Control System (WWMCCS) which provides the President, Secretary of Defense and senior military commanders with essential information pertaining to the need for action by US military forces and disseminates their decisions and orders to those forces. The program was established by the Deputy Secretary of Defense in 1976 to achieve new WWMCCS capabilities and to provide continuing improvements to the WWMCCS. To effect these improvements, the Defense Communications Agency (DCA) retains the responsibility for insuring overall program integration through implementation engineering and system planning.

C. (U) BASIS FOR FY 1983 RDT&E REQUEST: DCA technically supports, monitors, assists and advises the responsible components; Office of the Joint Chiefs of Staff (OJCS); Deputy Undersecretary of Defense for Communications, Command, Control and Intelligence (DUSD C³I); and other Defense Agencies on Command, Control and Communications (C³) related matters. In this capacity, DCA will continue to guide the implementation of near-term WWMCCS improvements and plan overall C³ systems improvements through engineering and programmatic analysis, promulgation of system planning documents, requirements analysis and definition, system integration and interoperability studies, and development of performance measure parameters.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: A major initiative under the Enhanced Post-Attack WWMCCS Capabilities project was to be the concept development for a [] launched [] communications satellite system for [] satellite communications. As a result of the termination of this project, the associated funds have been deleted from the Defense Communications Agency's request.

E. (U) OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate
Procurement	0	385	0
Operations and Maintenance	3,815	3,944	8,335

UNCLASSIFIED

Project: 2910
Program Element: 32019K
DoD Mission Area: #331

Title: WWMCCS Near/Mid-Term Engineering
Title: WWMCCS System Engineering
Budget Activity: Strategic Programs #3

F. (U) DETAILED BACKGROUND AND DESCRIPTION: Provides the development of system-level specifications, technical support to WWMCCS field nodes, and special studies of Command, Control and Communications (C³) problems and issues. These system engineering, planning, and field engineering efforts are required by the Defense Communications Agency (DCA) in order to fulfill its responsibility for technically guiding the implementation of new WWMCCS capabilities and directing the near/mid-range evolution of the WWMCCS. System engineering responsibilities for the WWMCCS are segregated into the areas of near/mid-term improvements and long-range planning. This project guides the implementation of new WWMCCS capabilities and performs the required engineering studies and analyses which are directed toward 1980's WWMCCS improvements. It also provides engineering support to field WWMCCS nodes directed toward mid 1980's WWMCCS improvements. The above mentioned efforts and their associated documents permit DCA to exert rational controls over the growth and modification of the WWMCCS and guide the members of the C³ community through current and future C³ planning.

G. (U) RELATED ACTIVITIES: For the new WWMCCS capabilities, the Army is the cognizant component for the implementation of Jam-Resistant Secure Communications and Mobile Command Centers, the Navy is the cognizant component for the Secure Voice/Graphics Conferencing project and the Air Force is the cognizant for the Proliferated Ground Wave Communications System. DCA is the cognizant component for the Command Information System. Each of these projects are also related to other on-going projects such as the Defense Communication System, WWMCCS Information System (WIS) Modernization and the CINC C³ Initiative Program.

H. (U) WORK PERFORMED BY: TRW, CSC, and ESI.

I. (U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: The WWMCCS Current System Description (CSD) was published in draft form in FY 78 and FY 79. The CSD first edition was published in FY 80. While the first edition did not describe all the WWMCCS nodes, it did describe all major nodes except for the Defense Agencies. Additional coverage was incorporated in an FY 1981 update which expanded the CSD to include representative alternates, emergency relocation sites, and the Rapid Deployment Joint Task Force. During FY 81 a method was developed, based upon the WWMCCS CSD, for system integration analyses of WWMCCS improvements.

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UNCLASSIFIED

2. (U) FY 1982 Program: WWMCCS engineering support and integration analysis will be accomplished to support near-term enhancements in the NMCS and CINC command facilities. Surveillance and Warning as well as communications initiatives will be evaluated to assure adequate integration into the WWMCCS. Engineering efforts will focus on interface and interoperability of improvements to provide a system approach toward WWMCCS upgrades. The WWMCCS Current System Description (CSD) will be refined and expanded to include the Defense Agencies and a study will be performed to determine the optimum manner of including Defense intelligence channels. A structure will be established to allow configuration control of the WWMCCS. Refinements in the CSD will be aimed at enhancing the usefulness of the CSD to planners and operators. A method will be developed to analyze the WWMCCS capabilities in stressed environments in order to determine deficiencies. Technical assistance will be started to the Commanders-in-Chief (CINC's) to support CINC command and control initiatives.

3. (U) FY 1983 Planned Program: The expanded effort in providing WWMCCS engineering support to CINC's and integration will continue during FY 83. Efforts will continue to support enhancements in the functional areas of communications, command centers and warning systems. The WWMCCS CSD will be expanded to include the Defense intelligence channels and to respond to changes in command configuration. Studies will be conducted utilizing the integration method developed in FY 81 and the deficiency analysis method developed in FY 82.

4. (U) FY 1984 Planned Program: The WWMCCS CSD will be refined to follow changes in command configuration. Studies and analysis will be conducted utilizing previously developed methods. The field engineering efforts will be continued.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: The WWMCCS CSD expansions will be published at the end of each fiscal year and incorporated with each field update. Studies and analysis of various projects/nodes will be performed continually and reported as completed. Field support will be provided on an ad hoc basis.

7. (U) <u>Resources (\$ in thousands):</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
	1,848	2,998	2,893	3,033	2,809	2,843

UNCLASSIFIED

Project: 2950
Program Element: 32019K
DoD Mission Area: #331

Title: Enhanced Post-Attack WWMCCS Capabilities
Title: WWMCCS System Engineering
Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: In October 1977, the Assistant Secretary of Defense (C³I) directed a review of the capabilities of the Worldwide Military Command and Control System (WWMCCS) to support general nuclear war. One of the findings of this review was that there are major deficiencies in the WWMCCS which limit the ability of WWMCCS to support the National Command Authorities (NCA) under certain attack conditions and for more. There are a number of conceptual alternatives for improving these deficiencies. However, today there is not sufficient technical information available to adequately assess the cost and performance risk associated with these alternatives. This project has been established to conduct research and development aimed at establishing a responsive, reconstitutable and enduring Command, Control and Communications (C³) system and support the acquisition of more WWMCCS General War capabilities. This program includes analyses to support the modification of existing plans, the development of new procedures to improve the use of current WWMCCS and non-WWMCCS systems and technology activities to enhance the capability, endurance and reconstitution of both the WWMCCS. The focus of the technology activities will be the development of detailed design and cost tradeoffs, testing and prototype development for technical and cost risk reduction, and the formulation of cost and schedule data to support informed decisions.

G. RELATED ACTIVITIES: On 2 October 1981, the Deputy Secretary of Defense directed Army, in coordination with DCA, to develop and deploy a Capability. On 9 December 1981, the Deputy Under Secretary of Defense (C³I) directed termination of the Program in favor of other, more enduring capabilities such as Radio and satellite communications.

H. (U) WORK PERFORMED BY: USAF, MITRE, IBM and TRW.

I. (U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: This project (formerly called WWMCCS Survivability R&D) began in FY 1980. Major efforts which were initiated include: an architecture for post-attack C³; detailed analyses of the design and cost tradeoffs associated with the reconstitution of critical systems; identification of communications uncertainties for highly survivable facilities; and definition of capabilities. Completed a concept of operations for a and completed construction of a mock-up. Initiated developmental design of a communications system to support our strategic forces following a nuclear attack. Initiated concept and design studies for alternative systems needed to support WWMCCS tactical warning and assessment needs. Completed an evaluation of communication system concepts. Completed an evaluation of alternatives to the Project which supported the termination of in favor of other communications alternatives such as

2. FY 1982 Program: Continue the on-going design and cost tradeoff analyses and accomplish other studies in support of the Army's effort on the [] network, develop and begin testing of an []/antenna receiving system, and initiate prototype [] system acquisition and testing. Initiate study of [] programs to determine feasibility of accelerating the acquisition of [] equipment to provide early Initial Operating Capability (IOC) for WWMCCS and other uses. Continue design studies for the [] and develop concepts for the [] surveillance demonstration. Funding increases in FY 1982 provide for major research and development acquisitions and prototype constructions to be initiated in FY 1982 and continued through FY 1984.

3. FY 1983 Planned Program: Continue the design and cost tradeoff analyses and Advanced Development Model (ADM) development efforts for the [] Continue prototype acquisition for [] systems and demonstration of [] antenna systems. Continue [] experiments. Demonstrate [] surveillance. Develop [] demonstration plan. Develop implementation plan for [] In coordination with JCS and services, determine application of equipment to satisfy WWMCCS and other user requirements.

4. FY 1984 Planned Program: Continue support of the Army [] effort. Continue to expedite the application of technology to satisfy user requirements. Accelerate the acquisition of an [] Surveillance System and the []

5. (U) Program to Completion: This is a continuing program with an overall objective of providing the WWMCCS with the enhanced post-attack capabilities required to become a reconstitutible and enduring C³ system.

6. Milestones:

- o DoD decision [] FY 84).
- o Demonstrate [] System (FY 84).
- o Demonstration [] is scheduled for FY 84.

7. (U) Resources (\$ in thousands):

	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
	14,033	29,439	28,076	14,712	11,182	5,495	4,307

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 3310
Program Element: #32019K
DoD Mission Area: Strategic C2 - #331

Title: WWMCCS System Engineering
Title: WWMCCS System Engineering
Budget Activity: #3 Strategic Programs

F. DETAILED BACKGROUND AND DESCRIPTION: This project provides the development of master planning guidance for C³ systems, technical and architectural plans and special studies of C³ problems and issues. These system engineering and planning efforts are required by the Defense Communications Agency (DCA) in order to fulfill its responsibility for technically guiding the implementation of new WWMCCS capabilities and directing the architectural evolution of the WWMCCS. System engineering responsibilities for the WWMCCS are segregated into the areas of near/mid-term engineering and long-range planning. The Defense Communications Agency provides the development of long range engineering plans and systems architectures to insure the overall integration of the WWMCCS. The above mentioned efforts and their associated documents permit DCA to exert rational controls over the growth and modification of the WWMCCS and guide the members of the C³ community through current and future C³ planning. Finally, effective in April 1980, DCA was designated Protocol Standardization Executive Agent for DoD with the responsibility for establishing and controlling protocol standards for common user data communications networks within DoD.

G. RELATED ACTIVITIES: DCA, through the Command and Control Technical Center, guides the implementation of new WWMCCS capabilities and performs the required engineering studies and analyses directed toward short-term WWMCCS improvements. DCA is also designated as cognizant component for the Command Information Subsystem. These efforts relate to other on-going WWMCCS programs under the Services and Defense Agencies (e.g. Theater Nuclear Forces C³, WIS modernization, WWMCCS warning systems, etc.).

H. WORK PERFORMED BY: MITRE, IBM, the Institute for Defense Analyses, as well as a new contractor to be competitively selected in the second quarter FY 1982.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

- 330 1. FY 1981 and Prior Accomplishments: FY 1977 and FY 1978 efforts concentrated on developing, coordinating and issuing technical and programmatic guidance for the implementation of the WWMCCS Selected Architecture as well as developing a more comprehensive system engineering program aimed at the total WWMCCS rather than just the future WWMCCS capabilities. A WWMCCS Five Year Plan has been annually published to provide the technical and programmatic guidance to resolve deficiencies in existing WWMCCS capabilities. System engineering assistance for CINC C3 related problems was initiated with the establishment of a WWMCCS System Engineering (WSE) European Office at HQ USEUCOM and WSE-Pacific office at HQ PACOM. Selected communications integration and mobile command center problems have been reviewed and analyzed for the development of alternatives to resolve future WWMCCS interoperability and standardization problems. Technical support was provided during FY 1981 for the finalization of architectural and communications technology for use in a NATO environment. A European Theater Nuclear Weapons C3 System Improvement Plan defining an orderly evolution from the existing and near-term planned system to a system which satisfies future theater requirements was published in FY 1981.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 3310
Program Element: #32019K
DoD Mission Area: Strategic C2 - #331

Title: WWMCCS System Engineering
Title: WWMCCS System Engineering
Budget Activity: #3 Strategic Programs

2. FY 1982 Program: Strategic C³ planning guidance for C³ programs will be developed for the Services and Agencies responsible for C³ programs. Existing technical issues for DoD HF programs will be identified and appropriate recommendations will be published in a DoD HF Improvement Plan. The C³ architectures will be reviewed and technically assessed for integration with the telecommunications and WWMCCS Information System architectures currently under development. Strategic C³ capabilities will continue to be assessed for improving the effectiveness of C³ in support of strategic/national weapons systems and forces. Theater Nuclear Weapons C³ system improvement planning efforts will continue for both the U.S. European Command (USEUCOM) and the U.S. Pacific Command (PACOM). Theater/tactical architectural efforts will continue and C² system engineering to the CINCs will continue for HQ USEUCOM, HQ PACOM and be initiated for HQ USREDCOM.

3. FY 1983 Planned Program: Basic system engineering efforts will continue to integrate the efforts of the military departments and defense agencies and insure the overall integration of C³ systems. Theater architectural efforts will continue and assistance to the WSE-USEUCOM, WSE-Pacific and WSE-USREDCOM field offices will be expanded in support of theater command and control programs. Additionally, a new field office will be opened at the Strategic Air Command to provide C² system engineering assistance. Systems analysis efforts will continue for the formulation of theater/tactical long-range plans, development of strategic C³ capabilities, and expansion of strategic force management activities. Theater Nuclear Weapons C³ system improvement planning efforts will lead to the development of a comprehensive improvement program. Work will expand into the development of protocol standards for computer communications networks. This work is essential for the interoperability of our information systems, especially as DoD moves into major modernization efforts like the WWMCCS Information System.

4. FY 1984 Planned Program: C³ master planning, system engineering, theater C³ improvement and WSE field engineering efforts will continue to provide the systems planning and architectural development necessary for integrated and balanced C³ capabilities. C² system engineering efforts for the Aerospace Defense Command (ADCOM) will begin with the establishment of WSE-ADCOM.

5. Program to Completion: This is a continuing program.

6. Milestones: Publish the final WWMCCS Five Year Plan (FYP 84), 1st Qtr FY 1982
 Publish a European Theater Nuclear Weapons C³ System Improvement Plan Supplement, 1st Qtr FY 1982
 Publish an initial HF Improvement Plan, 1st Qtr FY 1982
 Publish an initial C³ Master Plan Overview, 3rd Qtr FY 1982
 Publish a Strategic C³ Master Plan, 1st Qtr FY 1983
 Publish a Pacific Command Theater Nuclear Weapons C³ System Improvement Plan, 3rd Qtr FY 1983
 Initiate C² system engineering efforts for CINCSAC and CINCAD, during FY 1983
 Initiate C² system engineering efforts for CINCMAC, during FY 1986

7. <u>Resources (\$ in thousands)</u> :	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
RDT&E	4,098	7,792	11,658	11,222	11,391	10,856	11,094

J. TEST AND EVALUATION DATA: (Not Applicable)

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 3380

Title: Next Generation WWMCCS ADP

Program Element: #32019K

Title: WWMCCS System Engineering

DoD Mission Area: Strategic C2 - #331

Budget Activity: #3 Strategic Programs

F. DETAILED BACKGROUND & DESCRIPTION: This project started as the "Research and Development in the Operational Utility of WWMCCS ADP." Originally, experiments were designed to determine the operational utility of Automatic Data Processing (ADP) for WWMCCS. In response to Congressional direction, the Defense Communications Agency deleted the FY 1980 funding for the continuation of research and development efforts in the operational utility of WWMCCS ADP and, instead, established a new program entitled "Next Generation WWMCCS ADP Definition." This program supports the Defense Communications Agency's responsibilities for modernizing the current WWMCCS ADP systems (acquired from Honeywell Information Systems, Inc. in 1971) and developing an architectural foundation for a fully integrated WWMCCS Information System (WIS). The WIS is defined to encompass basic operational concepts, specific functional processing needs, information reporting requirements and procedures, data displays, communications, etc., as well as the ADP hardware/software assets, which support command and control operations.

G. RELATED ACTIVITIES: The Command Information Subsystem of DCA, the Advanced Command, Control and Communications Technology program of the Defense Advanced Research Projects Agency, the Network Front-End program of DCA, the Computer Security Consortium of DUSD (C³I) and the overall WIS Modernization program.

H. WORK PERFORMED BY: MITRE Corporation, Systems Development Corporation, TRW Corporation, IBM Corporation and the Services.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Published a Program Definition Plan for R&D in Operational Utility of ADP in support of the WWMCCS in FY 1977 and a Technical Development Plan for execution of the Program. Published a WWMCCS Information System Engineering Management Plan in early FY 1979 that provided a framework for the management and coordinated development of the WIS. Conducted security experiments in November 1980 which demonstrated potential security solutions for the current and future WWMCCS ADP systems. Delivered a progress report on modernizing the current ADP systems which support the WWMCCS to Congress in January 1981. In FY 1981, an ADP architecture was developed for the WIS and used to derive the WIS security requirements.

2. FY 1982 Program: Initiate a comparative analysis on data base management systems and techniques required to transition current WWMCCS data bases to the future system. Continue to review the WIS network capabilities, identify functional WIS network requirements and synthesize the planned WIS network capabilities. Develop design considerations for

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 3380

Program Element: #32019K

DoD Mission Area: Strategic C2 - #331

Title: Next Generation WWMCCS ADP

Title: WWMCCS System Engineering

Budget Activity: #3 Strategic Programs

terminal/hardware architectures which can support information collection and processing in the WIS environment. Continue the development of a WIS computer security architecture for different levels of classified information. Complete the development of a broad architecture for a more survivable and efficient Joint Reporting Structure network. Complete development of a report on WIS requirements, modernization and architecture. Support the initiation of WIS modernization efforts under the WIS Joint Program Manager (JPM).

3. FY 1983 Planned Program: None. Ongoing WIS modernization efforts will be the responsibility of the Air Force WIS Joint Program Manager.

4. FY 1984 Planned Program: None.

5. Program to Completion: The WIS Joint Program Manager will continue as the central focal point for coordinating and controlling all WWMCCS ADP upgrading and modernization activities. The procurement of equipment for specific WIS sites and the development of command and site unique portions of the WIS modernization will remain the responsibility of DCA and the Services.

6. Milestones: Publish the final WIS Modernization Report, 3rd Qtr. FY 1982.
Deliver the WIS Security Architecture Report to the WIS Joint Program Management Office (JPMO), mid FY 1982.
Transfer WIS modernization responsibilities to the JPMO during FY 1982.

7. <u>Resources (\$ in thousands):</u>	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
RDT&E	4,643	8,540	0	0	0	0	0

J. TEST AND EVALUATION Data: (Not Applicable)

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 33131K
DoD Mission Area: Strategic Communications #333

Title: MEECN
Budget Activity: Strategic Programs #3

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Cost
2181	System Operational Analysis	618	1591	1775	1971	Continuing	N/A
2182	System Performance Evaluation	1363	1960	2217	2801	Continuing	N/A
2183	System/Subsystem Planning	908	1653	1631	1651	Continuing	N/A
2184	Engineering Analysis and Development	701	1279	1222	1270	Continuing	N/A
2185	Strategic Connectivity Engineering	0	0	3000	3300	Continuing	N/A
TOTAL FOR PROGRAM ELEMENT		3590	6483	9845	10993		

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides the system engineering, development, test and evaluation, and technical support for the Minimum Essential Emergency Communications Network (MEECN). The MEECN is a diverse network of communications assets with the mission of providing highly reliable communications between the National Command Authorities (NCA) and the strategic forces deployed globally. The various component subsystems composing the MEECN are developed, operated, and maintained by the Services. This program element also supports the planning, engineering, and testing of the overall Strategic Connectivity Network which includes the functions of Tactical Warning/Attack Assessment, Conferencing, Emergency Action Message Dissemination, and Force Management.

C. BASIS FOR FY 1983 RDT&E REQUEST: This program element is comprised of five projects. System Operational Analysis provides the necessary analytical tools and studies to determine the technical and operational performance of the MEECN and MEECN Support Systems with regard to connectivity, survivability, and deficiencies in a simulated stressed environment. It also provides the vehicle for conduct of JCS and OSD (C³I) assigned system and equipment studies. System Performance Evaluation provides for the technical and operational testing, evaluation, and analysis of the following: current MEECN assets and Networks (Very Low Frequency/Low Frequency (VLF/LF), High Frequency (HF), Very High Frequency/Ultra High Frequency (VHF/UHF), and Super High Frequency (SHF)); overall MEECN; JCS operational exercises; the Worldwide Airborne Command Post (WWABNCP) System; and MEECN Support Systems in a non-stressed environment and in configurations simulating severe stress and trans and post-attack damage. System/Subsystem Planning produces the annual MEECN Master Plan. This Plan contains recommended improvements for consideration by the

Program Element: 33131K
DoD Mission Area: Strategic Communications #333

Title: MEECN
Budget Activity: Strategic Programs #3

JCS, Services and Defense Agencies. The Plan also provides consolidated guidance for formulating the Services and Defense Agencies Program Objective Memoranda. Engineering Analysis and Development assesses new procedures, equipments and systems from a cost and effectiveness viewpoint for possible inclusion into the MEECN. The objectives of Strategic Connectivity Engineering are to engineer and test a strategic connectivity capability which supports the command and control functions through all levels of nuclear conflict into the period of protracted war.

D. COMPARISON WITH FY82 DESCRIPTIVE SUMMARY: FY83 resources show a \$3,338,000 increase from FY82 to FY83. The bulk of this amount, \$3,000,000, is due to the inclusion of the Strategic Connectivity Engineering (SCE) project in this PE for FY83 to assure the provision of a "MEECN-like" focus for the additional critical emergency functions. This project was originally funded under PE 32016K until the PPBS cycle allowed transfer to this PE. A Program Plan has been produced which delineates those areas requiring additional investigation and funding. System Operational Analysis is increased by \$184,000 to allow more extensive MEECN modeling to enable greater analysis of survivability and connectivity in a simulated stressed environment. System Performance Evaluation is increased by \$257,000 to enable more in-depth operational testing and evaluation of current MEECN assets with additional emphasis on HF communications with the CINCPAC theater. The remaining projects, System/Subsystem Planning and Engineering Analysis and Development, will be reduced in FY83 by \$22,000 and \$57,000 respectively, as a result of changing priorities.

E. OTHER APPROPRIATION FUNDS:

<u>Project 2185</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
Procurement	0	0	10000	10000
Operation and Maintenance	0	0	880	1000

Project: 2182
Program Element: 33131K
DoD Mission Area: Strategic Communications #333

Title: Systems Performance Evaluation
Title: MEECN
Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: Provides for the technical and operational testing, evaluation, and analysis of current MEECN assets and networks, JCS operational exercises, and MEECN Support Systems in a non-stressed environment and in modified configurations simulating severe stress or trans-attack and post-attack damage. This project is composed of eight tasks. The VLF/LF Test and Evaluation, HF Test and Evaluation, VHF/UHF Test and Evaluation, and Network Performance Improvement tasks provide for testing and analysis to evaluate and improve the connectivity and operational capabilities of the particular MEECN communications networks. The Worldwide Network Assessment, JCS MEECN Exercise Evaluation, and Test and Evaluation Management Support tasks provide technical assistance, test, and analysis support to JCS in conjunction with POLO HAT and other exercises as called for by the MEECN Communications Plan and MEECN Test and Evaluation Program. The MEECN/MEECN Support Systems task provides for testing of MEECN/MEECN Support Systems in a simulated stressed environment to develop improvements in interoperability and operational procedures.

G. RELATED ACTIVITIES: The prime users of MEECN System Engineering products are the OSD, the JCS, the CINCs, the Services, the National Security Agency and the Defense Nuclear Agency. In addition, the MEECN is a worldwide diverse network of communications assets owned, operated and managed by the Services.

H. WORK PERFORMED BY: Naval Electronics Systems Engineering Agency, MITRE, ESI and TRW.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

Recommendations for improved interoperability and connectivity of the communication networks comprising MEECN were provided to the Services through the approved MEECN Master Plan. This plan is published annually. This project also provided guidance in conduct of the C³ Net Assessment task for the SecDef.

2. FY 1982 Program:

VLF/LF, HF, UHF (including SATCOM), and Emergency Rocket Communications Systems (ERCS) worldwide link and network tests and evaluations will continue. Adaptive HF/VHF development tests will be supported. Communication ranges of the revised airborne narrowband Secure Voice communications system will be determined. MEECN performance under selected trans-attack scenarios will continue. The FY81 Test and Evaluation Summary and FY83 Test and Evaluation Program Plan will be completed.

Project: 2182
Program Element: 33131K
DoD Mission Area: Strategic Communications #333

Title: Systems Performance Evaluation
Title: MEECN
Budget Activity: Strategic Programs #3

3. FY 1983 Planned Program:

Enhancements will be developed for establishing HF communications to and within the CINCPAC theater. Alternate means will be investigated to improve HF radio reliability, both for the Airborne Command Post and the Navy VLF/LF relay aircraft. This project will continue to support POLO HAT and other OJCS exercises and selected network tests and evaluations. The FY82 Test and Evaluation Summary and FY83 Test and Evaluation Program Plan will be completed.

4. FY 1984 Planned Program:

An operational concept and implementation method will be developed for an improved ECCM capability aboard WWMCCS airborne resources. Support to JCS sponsored exercises will continue with emphasis on maintaining connectivity to the forces and no-notice tests.

5. Program to Completion:

This is a continuing project.

6. FY 83 Milestones:

- o Forward to the Services, recommendations for enhancing HF communications to the non-CONUS theater.
- o Perform test and evaluation of WWABNCP capabilities in trans and post-attack periods.
- o Publish VLF/LF coverage charts for CINC and Service planning.
- o Conduct evaluation of Air Force satellite communication performance of WWMCCS airborne resources.

7. Resources: (\$ in Thousands)

<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
1363	1960	2217	2801

Project: 2185
Program Element: 33131K
DoD Mission Area: Strategic Communications #333

Title: Strategic Connectivity Engineering
Title: MEECN
Budget Activity: Strategic Programs #3

F. DETAILED BACKGROUND AND DESCRIPTION: Provides a single engineering focus for survivability of essential communications supporting the emergency action functions of: Tactical Warning/Attack Assessment; Conferencing; Emergency Action Message Dissemination; and Force Management. This project consists of three tasks. Strategic Connectivity Planning provides for analytic support and publication of the Strategic Connectivity (SC) Program Plan and Engineering Plan. Strategic Connectivity Engineering/Analysis provides for engineering and analysis support to evaluate threats and identify technical alternatives to assist or expedite the implementation of system improvements. Test and Evaluation provides for planning and conduct of exercises to evaluate the performance of strategic connectivity systems.

G. RELATED ACTIVITIES: Joint Strategic Connectivity Staff (JSCS).

H. WORK PERFORMED BY: MITRE, TRW, CSC, and ESI.

I. PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

This project was initiated in FY81.

2. FY 1982 Program:

Two annual planning documents are produced, the SC Engineering Plan and the SC Program Plan. These plans provide "road maps" for enhancing strategic connectivity. In addition, Technical Analysis/Cost Estimates (TA/CE) are developed to help solve problems in the areas of warning, conferencing, and force management. Various UHF and VF equipment are tested under varying conditions to establish performance capabilities and deficiencies.

3. FY 1983 Planned Program:

The SC Engineering Plan and Program Plan will be reviewed and updated with emphasis on the threat to strategic connectivity in the FY85-89 time frame. The SC Test and Evaluation Plan will be published. Program plans will be developed for various subsystems.

Project: 2185
Program Element: 33131K
DoD Mission Area: Strategic Communications #333

Title: Strategic Connectivity Engineering
Title: MEECN
Budget Activity: Strategic Programs #3

4. FY 1984 Planned Program:

Continue to maintain liaison with and monitor activities of C³I, JCS, DIA, DNA and the Military Services on related High Altitude Electromagnetic Pulse (HEMP) programs. The analysis and system engineering portion of this project would have identified near-term improvements with respect to connectivity. Procurement funds for these improvements will begin to be transferred to the implementing agencies.

5. Program to Completion:

This is a continuing project.

6. FY 1983 Milestones:

- o Publish the Strategic Connectivity Test and Evaluation Plan.
- o Publish Technical Analysis/Cost Estimates (TA/CEs) for UHF SATCOM and HF orderwire system for common carrier reconstitution.
- o Publish updated SCE Program Plan and Engineering Plan.

7. Resources: (\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
RDT&E	0	0	3000	3300

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element #33152K

DoD Mission Area: Strategic Information Systems - #334

Title: WWMCCS Information System

Budget Activity: #3 Strategic Programs

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	3,884	0	0	Continuing	Continuing
3500	WIS Joint Program Management Office Support	0	3,884	0	0	Continuing	Continuing

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the modernization of current Worldwide Military Command and Control System automatic data processing systems (WWMCCS ADP) to provide an integrated, reliable, and operationally responsive WWMCCS Information System (WIS) which meets the command and control needs of the National Command Authorities and senior U.S. military commanders. In response to Congressional requests, a progress report on the results of current activities for further defining the operational information system requirements and making the basic architectural choices for the WWMCCS Information System was submitted to Congress in January 1981. This report outlines the establishment of a WIS Joint Program Manager and supporting staff to manage the central development and acquisition of standard WIS components and act as the DoD focal point for modernization planning.

C. BASIS FOR FY 1983 RDT&E REQUEST: The WIS Joint Program Management Office (JPMO) requires funds to fulfill its responsibilities for providing: architectural and overall system engineering to include the preparation of top-level performance specifications; the development, promulgation and monitoring of technical and interface standards within the WIS; and overall interface definition with other systems. FY 1983 funding for these efforts will be requested by the Air Force.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Since the time of the FY 1982 RDT&E Descriptive Summary submission, the Deputy Secretary of Defense has directed the establishment of a WIS Joint Program Manager in the Air Force. WIS Joint Program Management Office support funding has been transferred to the Air Force.

E. OTHER APPROPRIATION FUNDS:

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>
Operations and Maintenance	0	610	0

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 3500

Program Element: #33152K

DoD Mission Area: Strategic Information Systems #334

Title: WIS Joint Program Management Office Support

Title: WWMCCS Information System

Budget Activity: #3 Strategic Programs

F. DETAILED BACKGROUND AND DESCRIPTION: In tasking to the WWMCCS System Engineer in July 1978, the Assistant Secretary of Defense for Command, Control, Communications and Intelligence, ASD (C³I), established the WWMCCS Information System. The WIS program planning was documented in an Engineering Management Plan in October 1978 and approved by ASD (C³I) in 1979. In January 1981, a progress report on WIS was submitted to Congress which outlined the establishment of a WIS Joint Program Management Office to provide the centralized full-time management necessary for the implementation of the WIS. The Deputy Secretary of Defense in a memorandum dated 5 November 1981, directed the establishment of the WIS Joint Program Management Office by assigning the role of WIS Joint Program Manager to the U.S. Air Force.

G. RELATED ACTIVITIES: Existing WWMCCS ADP capabilities are administered and supported by the individual services and defense agencies under the overall WWMCCS ADP Program. Additional WWMCCS ADP capabilities currently under development and/or being implemented include the development of a Command Information Subsystem and enhancements to the WWMCCS Intercomputer Network with the Defense Communications Agency as cognizant agent.

H. WORK PERFORMED BY: FY 1982 efforts are being performed by the MITRE Corporation. Additional FY 1982 efforts and future WIS modernization efforts will be performed under the WIS Joint Program Manager.

I. PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Prior WWMCCS Information System Modernization initiatives were performed under the Next Generation WWMCCS ADP project and funded by Program Element 32019K.

2. FY 1982 Program: The Defense Communications Agency will define the major components and functions of the modernized WIS and refine the four phases of WIS modernization as defined in the January 1981 report to Congress. These efforts will be transitioned to the WIS Joint Program Manager and additional WIS modernization efforts will be initiated by the WIS Joint Program Manager.

3. FY 1983 Program: None. The Air Force WIS Joint Program Manager will assume full responsibility for the modernization of the WIS.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 3500

Title: WIS Joint Program Management Office Support

Program Element: #33152K

Title: WWMCCS Information System

DoD Mission Area: Strategic Information Systems #334

Budget Activity: #3 Strategic Programs

4. FY 1984 Program: None. The JPMO will continue the development of the joint portions of the WIS modernization.
5. Program to Completion: This is a continuing program under the Air Force and will include system engineering and system integration for the WIS, the development of procurement specifications for all of the WIS components, and the development of the major new WIS functional capabilities.
6. Milestones: Complete a functional description of the WIS Transition Package - 1st Qtr. FY 1982.
Prepare an initial description of a WIS computer simulation model - 1st Qtr. FY 1982.
Complete an analysis of the WIS requirements collection effort - 4th Qtr. FY 1982.
Transfer remaining WIS modernization efforts to the WIS JPMO - Late FY 1982.

7. <u>Resources (\$ in thousands):</u>	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
RDT&E	0	3,884	0	0	0	0	0

J. TEST AND EVALUATION DATA: (not applicable)

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 21135K
DoD Mission Area: Theater Command & Control #341

Title: CINC COMMAND & CONTROL INITIATIVES
Budget Activity: Tactical Programs #4

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional To Completion	Total Estimated Cost
2541	CINC C ² INITIATIVES	0	2719	700	746	Continuing	N/A
TOTAL FOR PROGRAM ELEMENT		0	2719	700	746		

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The CINC Command and Control Initiatives program element was established during FY 82 in response to the need for military commanders to have the capability to adapt, modernize, and maintain their unique command and control systems. Funding under this program element permits the CINCs to tailor, by means of near-term, low-cost enhancements, their unique and dynamic command and control systems to their own particular missions, geographic areas of responsibility, and individual styles of command. All projects are validated by the JCS.

C. BASIS FOR FY 1983 RDT&E REQUEST: RDT&E funds will be required annually to provide the CINCs with the capability to perform near-term, low-cost research and studies in order to implement timely improvements to their unique command and control systems. It is expected that the CINCs will use these funds primarily to adapt and evolve their existing command and control systems to meet unforeseen and, therefore unprogrammable requirements. The RDT&E for enhancements instituted under this program should normally be completed within one fiscal year and is expected to result in discernable improvements in the readiness and combat capability of the commands. This program will be a continuing effort with outyear funding based on anticipated needs and cost escalation factors.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: (\$ in thousands)
Initial R&D was conducted in FY82. It is anticipated that future R&D will be minimal and that the bulk of expenditures will be in Procurement and O&M for low cost short term projects.

E. OTHER APPROPRIATION FUNDS:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate
344 Procurement	0	4800	6580
Operations & Maintenance	0	3000	2700

Project: 2541
Program Element: #21135K
DoD Mission Area: Theater Command and Control #341

Title: CINC C2 Initiatives
Title: CINC Command and Control Initiatives
Budget Activity: Tactical Programs #4

F. DETAILED BACKGROUND AND DESCRIPTION: The CINC C² Initiatives program is intended to make the command and control systems of the commanders of the Unified and Specified Commands more responsive to their unique and dynamic requirements. The establishment of this program was based on a July 1978 Defense Science Board study and subsequent reinforcing DoD studies on command and control which felt it essential that the CINC's be provided with sufficient funding to adapt or enhance their command and control systems to meet unforeseen events or situations. Such enhancements are to be primarily low-cost, near-term (current year) fixes to existing systems which would result in their evolutionary upgrades.

G. RELATED ACTIVITIES: This program is directly related to existing and programmed CINC command and control systems. In addition to being related to command and control programs, this program is directly related to WWMCCS Communications, WWMCCS Command Centers, WWMCCS ADP, and WWMCCS Surveillance and Warning capability improvements outlined in the current WWMCCS Five Year Program and WWMCCS Five Year Plan.

H. WORK PERFORMED BY: CINC Initiatives projects will be implemented by the appropriate CINC support service, service components and selected contractors as required.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: This project commenced in FY 1981 and was minimally funded directly under non-DCI program elements.

2. FY 1982 Program: The CINCs will be given the capability to implement near-term, low-cost improvements to their command and control systems. Since funds and control have been centralized under one program element and procedures standardized, the level of enhancements to CINCs systems will be optimized. During this period the centralization of funds was accomplished and procedures were established which will result in improved project management.

3. FY 1983 Program: The CINCs capabilities to implement near-term, low-cost improvements to their command and control systems as originally conceived and planned will be continued.

4. FY 1984 Program: Since the primary objective of this program is to address those critical requirements and deficiencies in CINC command and control systems which arise due to unforeseen situations, specific CINC C² improvement tasks will not be determined until near the beginning of FY 1984.

Project: 2541
Program Element: #21135K
DoD Mission Area: Theater Command and Control #341

Title: CINC C2 Initiatives
Title: CINC Command and Control Initiatives
Budget Activity: Tactical Programs #4

5. Program to Completion: This is a continuing program.

6. Milestones: Continuing program; funding was consolidated and project management centralized under the Defense Communications Agency, in FY 1982. CINCs are receiving timely assistance in upgrading their command and control systems upon request.

7. <u>Resources (\$ in thousands)</u> :	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
CINC C ² Initiatives	0 1/	2719	700	746	780	815	850

1/ FY 1981 funding for this project was in the MILDEP budgets.

J. TEST AND EVALUATION DATA: (Not Applicable)
thousands):

29 January 1982

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33126K
DoD Mission Area: Common User Communications #363

Title: Long Haul Communications (DCS)
Budget Activity: Intelligence & Communications #5

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

	<u>FY 81 Actual</u>	<u>FY 82 Estimate</u>	<u>FY 83 Estimate</u>	<u>FY 84 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
TOTAL FOR PROGRAM ELEMENT	14319	18200	18935	19136	Continuing	Not Applicable
Project						
Number Title						
1012 AUTOVON/DSN	2165	2953	2983	3150	Continuing	Not Applicable
1032 Secure Voice Improvement Program	1161	476	280	280	Continuing	Not Applicable
1053 AUTODIN Improvement Program	2955	2650	2754	2890	Continuing	Not Applicable
1070 System Design and Integration	1565	2365	3534	4027	Continuing	Not Applicable
1110 Defense Satellite Communications System	1953	2731	1978	2435	Continuing	Not Applicable
1130 Terrestrial Transmission	415	853	680	700	Continuing	Not Applicable
1170 Survivability	739	456	1995	1205	Continuing	Not Applicable
1190 System Control	471	644	1300	1400	Continuing	Not Applicable
3070 System Architecture and Integration	0	1095	749		Continuing	Not Applicable
4000 MILSATCOM Systems	2018	1867	2682	3049	Continuing	Not Applicable
1091 USDCFO	877	1010	*	*	Continuing	Not Applicable
9000 PD-53/NSC Initiatives	0	450	**	**	Continuing	Not Applicable
9500 Other Projects	0	650				Not Applicable

*To be transferred to O&M funding.

**To be transferred to PE 33127K.

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the development and systematic improvement of the Defense Communications System (DCS) including the Defense Satellite Communications System (DSCS); and the development of architecture specifications and system design for the DoD end-to-end communications. The DCS is the worldwide strategic communications system for the day-to-day operation of the DoD, and is the core of the DoD wartime communications capability providing communications for the National Command Authorities (NCA), the Joint Chiefs of Staff (JCS), the Commanders in Chief (CINCs), and other critical subscribers. The efforts in this program element particularly emphasize the development of a DCS that is wartime endurable, capable of reacting to and operating well under a variety of crisis situations including war, and is still peacetime effective. The DCS must be designed as a robust telecommunications system, capable of continued support of its command and control function as long as a significant number of subscribers survive. This includes the capability to rapidly extend service to remote areas, quickly restore disrupted trunks, and transition smoothly from peacetime to wartime.

This program element also supports the development of the Military Satellite Communications (MILSATCOM) Architecture, objective of which is to establish a single coordinated approach to the planning, development, acquisition, and operational deployment of secure, reliable, enduring and cost effective DoD satellite communications. This coordinated approach serves to ensure maximum interoperability and compatibility among different DoD satellite systems and with other military and commercial communications systems. In FY 81 and 82, this program element also supports the engineering for the resolution of interface problems between the integrated communications systems of NATO and the DCS. In FY 82, this program element also supports the effort with AT&T to develop and implement standard design and maintenance criteria for protection of future fiber optics transmission system against nuclear effects as required under Presidential Directive-53 (PD-53), and the efforts on improving circuit reliability of WWMCCS Intercomputer Network and on improving survivability of certain White House Communications facilities.

C. BASIS FOR FY 83 RDT&E REQUEST: The major thrusts of the FY 1983 program are directed toward supplementing the in-house efforts in removing the deficiencies in durability/survivability and responsiveness of the DCS, insuring the compatibility/integration of the various DoD telecommunications architectures, and improving the cost effectiveness of the DCS. Illustrative tasks include: (1) Development of a rapidly extendable/reconfigurable, wartime endurable DCS design, including physical survivability, Electronic Warfare and High Altitude Electro-Magnetic Pulse (HEMP) considerations; with emphasis on solving the system control and interface issues among satellite and terrestrial communications and between the various elements of the Defense Switched Network (DSN). (2) Development of the DSN concept to strongly influence the common-user architectural efforts and provide guidance for near-term choices. (3) Analysis and refinement of the evolving (packetized) AUTODIN to ensure wartime robustness and graceful degradation, and unification of the evolving Integrated AUTODIN Systems Architecture and AUTOVON architectures and designs. (4) Development of a Jam Resistant Secure

Communications (JRSC) system to support critical users during crisis and wartime situations through the use of the DSCS Phase III satellite and earth terminal equipment and related ground communications equipment. (5) System engineering for the DSCS including formulation of concepts, development of system/subsystem performance specifications, interface analysis, and testing and evaluation of space, ground and control subsystems. (6) Development of an architecture/design plan for the Joint Multichannel Trunking and Switching System (JMTSS). (7) Redefinition of the MILSATCOM architecture including development of candidate options for future systems, and a comprehensive requirements evaluation. The MILSATCOM architecture addresses the continued use of the existing investment in space and ground systems and those planned for procurement in the early 1980's.

The DCS RDT&E expenditures in the above areas, although relatively small, will continue to exert the necessary high leverage guidance and direction on the subsequent subsystem and equipment expenditures by the military departments in support of the DCS.

D. COMPARISON WITH 1982 DESCRIPTIVE SUMMARY: Further emphasis has been placed on achievement of a wartime capability for the DCS, our major goal. New programs on JRSC and JMTSS have been added.

E. OTHER APPROPRIATION FUNDS: None

29 January 1982

Project: 1012
Program Element: #33126K
DoD Mission Area: Common User Communications #363

Title: AUTOVON/DSN
Title: Long-Haul Communications
Budget Activity: Intelligence and Communications #5

F. DETAILED BACKGROUND AND DESCRIPTION: AUTOVON has been the operational common user voice communications network for the Department of Defense (DoD). The AUTOVON network also provides long-haul connectivity for secure voice and data services. Because of the effects of tariff charges that threaten to add over \$100 million to the annual operating expenses for CONUS AUTOVON, and more importantly, because of the changed threat, it is essential that a restructuring of the network be undertaken on an urgent basis. Comprehensive studies by DCA have resulted in agreement to proceed toward a Worldwide Digital System Architecture (WWDSA) for the DoD and a plan has been developed for a Defense Switched Network (DSN) as the principal system for achieving the WWDSA objectives. The DSN will provide a more flexible, economical, and survivable network along with improved grade-of-service by exploiting state-of-the-art technology in switching, transmission and terminal devices. It will incorporate advanced system control capabilities; more economical and survivable command and control routing techniques; and integration of clear and secure voice, data and facsimile traffic. It will provide greater and more efficient use of satellite facilities; greater interoperability with other networks; and faster connectivity and other features. Commercial developments, and public networks will be used throughout the CONUS to conserve resources and to minimize investment and capital costs to the government.

G. RELATED ACTIVITIES: The AUTOVON/DSN will continue to be one of the major components of the DCS. The RDT&E efforts being performed in Terrestrial Transmission, System Control, System Design and Integration, DSCS, and Secure Voice Improvement Program (SVIP) projects are related to this project.

H. WORK PERFORMED BY: GTE Products Corp., Computer Science Corporation, MITRE, and M.I.T. Lincoln Laboratory.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: FY 81 and prior accomplishments have been oriented towards defining issues and assessing problem areas. In addition, new and optimized voice Analog/Digital (A/D) techniques have been pursued consistent with future digital network concepts. Digital switch configurations, both for stand-alone AUTOVON type service, and dual-function service (PABX or Base Central Office and AUTOVON), have been analyzed. Alternative configurations for the CONUS DSN have been evaluated and guidelines for a preliminary DCS system specification have been developed.

2. FY 1982 Planned Program: A draft switch specification will be developed with capabilities based upon commercial practices and commercially developed equipment. Analysis to determine the extent to which the lease of commercial facilities can provide service will be accomplished. System engineering work will be extended to examine commercial satellite usage, provide an engineering plan, develop techniques for extracting management information, and develop DSN concepts for European and Pacific areas. EISN system level experiments will support development of functional design specifications of the DSN in the areas of restoral, reconfiguration, and extension procedures for wartime.

3. FY 1983 Planned Program: The evaluation criteria for the elements of the Common Channel Signaling (CCS) system will be completed. Assessments of the needed modifications or additions to switch hardware and/or software to accommodate CCS and analysis and recommendation of encryption methods for CCS channels will be accomplished. Exploratory hardware implementing the objective speech quality measuring techniques and demonstrating terminal capability to users will be developed. EISN system level experiments will continue with emphasis toward an integrated and endurable DCS.

4. FY 1984 Planned Program: A functional specification of the CCS including capabilities for interoperation with commercial and tactical signaling systems will be developed. The system control and management data to be transmitted on the CCS signaling channel will be defined. The objective measuring techniques will be applied to new A/D equipment and initial work on the High Quality Interoperable Element of the World Wide Digital Systems Architecture (WWDSA). Satellite Demand Assigned Multiple Access (DAMA) capability will be incorporated within the DSN. System level experiments will address the problems of incorporating data and facsimile into the DSN design and appropriate design criteria will be developed. Engineering plans will be modified to include the schedules for networks that will interoperate with the DSN to insure coordinated progress.

5. Program to Completion: The AUTOVON RDT&E program will build upon and complement the work that was completed previously. Interoperation requirements for civil, tactical and commercial networks will be completed and integrated into DSN engineering. The integration of Secure Voice Service into the DSN will be accomplished and data/graphics operation using the DSN will be initiated.

6. Milestones: Work under this program is a continuing effort.

7. Resources: (\$ in thousands)

<u>FY 81</u> <u>Actual</u>	<u>FY 82</u> <u>Estimate</u>	<u>FY 83</u> <u>Estimate</u>	<u>FY 84</u> <u>Estimate</u>
2165	2953	2983	3150

K. TEST AND EVALUATION DATA: Not applicable.

29 January 1982

Project: 1053
Program Element: #33126K
DoD Mission Area: Common User Communications #363

Title: AUTODIN Improvement Program
Title: Long-Haul Communications
Budget Activity: Intelligence and Communications #5

F. DETAILED BACKGROUND AND DESCRIPTION: The AUTODIN Improvement Program provides for the evolutionary implementation of a common-user data communications system for the Department of Defense (DoD). AUTODIN I is the currently operational narrative/record message system. The AUTODIN II, a subsystem of the near-term DCS, is the initial CONUS implementation of a common-user packet switched system. The Interservice/Agency AMPE (I-S/A AMPE) (IOC in the 1986 time period) will provide modernized automatic message service in a more dispersed and survivable network configuration. Continued RDT&E will be required to accomplish the evolutionary development of these three AUTODIN Improvement Program components, and to accomplish the overall functional design for incorporating them into an end-to-end, secure, worldwide Integrated AUTODIN System (IAS) which addresses and includes the backbone, access and local subscriber networking areas.

G. RELATED ACTIVITIES: The AUTODIN is one of the major components of the second generation DCS. The efforts being performed in AUTOVON/DSN, Secure Voice Improvement Program, Terrestrial Transmission, System Control, System Design and Integration, and DSCS Projects are related to this project.

H. WORK PERFORMED BY: Stanford Research Institute, Bolt-Beranek and Newman, University of Southern California, Booz-Allen, MITRE, System Development Corporation, NOSC, DARPA and the Army.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: AUTODIN II has achieved Initial Operating Capability (IOC) in July. The functional design for the mid-term DCS has been developed, and the implementation process has started. Functional specifications for a common family of AUTODIN II terminals have been developed. Host level protocols for AUTODIN II users have been developed, tested, and are now becoming standard. The Ada DoD High Order Language has been evaluated for application to the DCS. The principles of end-to-end security have been analyzed, and the areas of their applicability to AUTODIN II have been defined.

2. FY 1982 Planned Program: The functional design to implement the IAS as a survivable network will be substantially completed. Survivability will be achieved by increasing the numbers of packet switch nodes, dispersing them,

and redistributing functions between the access and backbone areas. In addition, survivability will be enhanced by the development of gateways to allow interoperation between different networks such as the public data networks. An independent verification and validation of the AUTODIN II software will be performed.

3. FY 1983 Planned Program: Starting in FY 83, the effort to achieve an even more survivable distributed network will be expanded by integrating data communications into the Defense Switched Network (DSN). The secure remote programming of switches will become a major effort, and the applications of end-to-end encryption will be initiated. Engineering models of End-to-End Encryption (E³) devices will be used in a realistic system field test to evaluate a complete E³ system design.

4. FY 1984 Planned Program: Many of the results of the preceding efforts will be reaching the field. Most of the functional designs will be completed and will be in the implementation phase. This year will see the finalized functional design for the IAS, and further fundamental work will be started in integrating new services and technologies for future data communications.

5. Program to Completion: Particular attention will be paid to the closer integration of the DCS voice and data subsystems, and to the development of new services and capabilities. The entire thrust of the programs will be to achieve a survivable, distributed data system by incorporating the technology of end-to-end encryption, reducing the size and manning of the switches, and achieving integration with other systems such as the DSN, and packet radio networks, and satellite networks.

6. Milestones: Work under this program is a continuing effort.

7. Resources: (\$ in thousands)

<u>FY 81</u> <u>Actual</u>	<u>FY 82</u> <u>Estimate</u>	<u>FY 83</u> <u>Estimate</u>	<u>FY 84</u> <u>Estimate</u>
2955	2650	2754	2890

K. TEST AND EVALUATION DATA: Not Applicable

29 January 1982

Project: 1070
Program Element: #33126K
DoD Mission Area: Common User Communications #363

Title: System Design and Integration
Title: Long-Haul Communications
Budget Activity: Intelligence and Communications #5

F. DETAILED BACKGROUND AND DESCRIPTION: The overall goals of this project are to ensure the development of long-haul communications systems for the DoD that are survivable and as responsive as possible to user needs in wartime and peacetime and are properly integrated to achieve such capabilities. The project supports the development of performance objectives, system specifications, survivability enhancement and the resolution of key interface and integration issues. It also includes efforts to develop facilities design criteria that will improve the responsiveness and survivability of the DCS. Emphasis is placed on maintaining vital services to critical users under wartime conditions. The project specifically includes support for an expedited Secure Voice and Graphics Conferencing (SVGC) capability, development of Jam-Resistant Secure Communications (JRSC), and system engineering for the Joint Multichannel Trunking and Switching Systems (JMTSS).

G. RELATED ACTIVITIES: The efforts underway in Terrestrial Transmission, DSCS, System Control, AUTOVON/DSN, Secure Voice Improvement Program (SVIP), AUTODIN Improvement Program and Survivability are related to this project.

H. WORK PERFORMED BY: BDM Corporation, Computer Science Corporation, MITRE and the Army.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Developed guidelines for a preliminary DCS system specification and evaluated interface subsystem issues. Developed the first alternative architectures for the Worldwide Secure Voice and Digital Systems. Evaluated alternatives for network design and improvement of the European DCS in a wartime or stressed condition. Developed a methodology for identifying and evaluating DCS subsystem interfaces. Selected the engineering criteria for digital technical control facilities. Developed interoperability configuration between the DCS and tactical access area. The WWMCCS communications support consisted of evaluating DSCS/DCS system design to support an integrated conferencing system, and analyzing DCS interface and integration issues to assure that the DCS digital subsystems are successfully integrated in the DCS planning.

2. FY 1982 Planned Program: Translate the results of recent Integrated Transmission, Switching and Technical Control (ITSTEC) architectural studies into system configuration and performance objectives on a user-to-user basis. Recommend a JMTSS design for the readiness command and a baseline system topology for the Pacific command. Develop system specifications for the final version of an integrated secure conferencing capability for WWMCCS and SVIP users. Develop utilization engineering plans and system level specifications for the JRSC.

3. FY 1983 Planned Program: Resolve system interface and integration issues related to integrating the DSCS, AUTODIN II and other subsystems into the mature DSN. Complete plans for implementation of an early operational capability for SVGC in the Pacific Command. Complete interface control documents for SVGC. Develop COMSEC interface designs to achieve an end-to-end encrypted conferencing capability. Incorporate new developments and technological advances into DCS facilities criteria and evaluate them.

4. FY 1984 Planned Program: Refine and enhance the operational capability of SVGC equipment. Complete transition plans to implement SVGC capabilities at individual fixed command centers. Complete development of a military handbook on DCS facilities and develop design specifications for selected DCS facilities alternatives.

5. Program to Completion: The efforts in systems interface and integration definition will be expanded to establish criteria for system validation. The design of the integrated access area subsystem will be verified. Operational procedures will be validated and refined as necessary to provide critical command and control users with responsive, secure and survivable communications via the SVGC and JRSC programs.

6. Milestones: Work under this program is a continuing effort.

7. Resources: (\$ in thousands)

<u>FY 81</u> <u>Actual</u>	<u>FY 82</u> <u>Estimate</u>	<u>FY 83</u> <u>Estimate</u>	<u>FY 84</u> <u>Estimate</u>
1565	2365	3534	4027

K. TEST AND EVALUATION DATA: Not applicable

29 January 1982

Project: 1110
Program Element: #33126K
DoD Mission Area: Common User Communications #363

Title: Defense Satellite Communications System (DSCS)
Title: Long-Haul Communications
Budget Activity: Intelligence and Communications #5

F. DETAILED BACKGROUND AND DESCRIPTION: This project provides RDT&E to support the DSCS III, Post-DSCS III and Future DSCS Systems including the 30/20 GHz system. The major objective of the DSCS RDT&E is to improve durability and responsiveness of the DSCS network to serve users including the DSCS baseline, DCS/DSN, WWMCCS, and wideband data users. This requires increased Anti-Jamming (AJ) protection in the DSCS III System by satellite and ground segment enhancements, and utilization of available bandwidth to provide significantly greater AJ protection in the Post-DSCS III timeframe; increased nuclear survivability of the DSCS network to propagation threats, physical threats, and High Altitude Electro-Magnetic Pulse (HEMP) threats; improved control and responsiveness for AJ and non-AJ users; assessing survivability by simulation and testing; and development and testing of advanced concepts and subsystems to comply with MILSATCOM and future DCS objectives.

G. RELATED ACTIVITIES: DSCS is one of the major components of the DCS. The efforts being performed in Survivability, Terrestrial Transmission, System Control, System Design and Integration, and Secure Voice Improvement Program projects are related to this project.

H. WORK PERFORMED BY: Computer Science Corporation, Stanford Research Institute and Systems Technology, Inc.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. Progress to Date: Performed DSCS System engineering to support the program and transition plans, allied use/interoperability agreements, WWMCCS integration studies, and space segment deployment studies. Developed Real-Time Adaptive Control (RTAC) system-level specification and subsystem performance specification for USA/USAF development of hardware. Investigated new AJ techniques and prepared a design approach for a smaller, less expensive and more efficient equipment. Determined control issues associated with WWMCCS AJ conferencing and Satellite Communications simulator. Completed system engineering required for development and implementation of digital ground segment, development of DSCS III and US/NATO interoperability; and development of operational concepts for DSCS II ECCM network. Formulated Post-Phase III concepts/configurations and functional design/performance specifications.

2. FY 82 PROGRAM: Initiate Phase III ECM and other survivability enhancements for spacecraft and ground segment developments. Initiate Post-Phase III 30/20 GHz modulation and earth terminal subsystem developments and continuation of 30/20 GHz spacecraft component developments in support of MILSATCOM objectives for survivable support to wideband data users. Complete real time adaptive control system development.

3. FY 83 PROGRAM: Continue Phase III ECM and other survivability enhancements to spacecraft, ground, and control segment developments. Initiate development of 30/20 GHz communications payload on DSCS III and 30/20 GHz spacecraft command/telemetry in support of MILSATCOM objectives for survivable support to wideband users.

4. FY 84 PROGRAM: Continue Post-Phase III 30/20 GHz modulation and earth terminal subsystem developments. Evaluate MilDep equipment specification/ADM performance for system requirements. Formulate system designs for Future DSCS to support DCS.

5. FY 85-88 PROGRAM: Complete DSCS III ECM and physical survivability enhancements to spacecraft/ground/control segment developments. Complete Post-Phase III 30/20 GHz subsystem development including EDM for low rate initial production for support of IOC in 1990.

6. MILESTONES: Work under this program is a continuing effort.

7. RESOURCES: (\$ in thousands)

<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>
<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>
1953	2731	1978	2435

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 4000
Program Element: #33126K
DoD Mission Area: Common-User Communications - #363

Title: Military Satellite Communications (MILSATCOM)
Title: Long-haul Communications - LCS
Budget Activity: #5 Intelligence & Communications

F(U)DETAILED BACKGROUND AND DESCRIPTION: This project supports the Military Satellite Communications (MILSATCOM) Systems Office (MSO) in its efforts to provide an overall DoD satellite communications systems architecture. The objective of this effort is to establish a single coordinated approach to the planning, development, acquisition, and operational deployment of reliable, enduring and cost effective DoD satellite communications. This coordinated approach serves to ensure maximum interoperability and compatibility among different DoD satellite systems and with other military and commercial communications systems.

G(U)Related Activities: The Defense Satellite Communications System (33126K, 33142A, 33109N, 33110F), and Fleet Satellite Communications (63431F), Air Force Satellite Communications System (33601F), and MILSTAR (33603F) are included in the MILSATCOM Systems Architecture by definition.

H(U)WORK PERFORMED BY: FY 1981 and Prior - Collins, LinCom, Raytheon, Computer Sciences Corp., Stanford Research Institute, Rockwell International, and MIPRs to Air Force for Lincoln Laboratory, Aerospace Corporation, and Rand Corporation. FY 1982 - Rockwell International, MIPR to Air Force, and competitive contracts.

I.(U)PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The first MILSATCOM Systems Architecture was published in 1976. It was revised in 1979, reflecting a three segment architecture (strategic, tactical, and nuclear capable force systems). The documentation associated with this architecture provided a comprehensive user requirements data base, identified candidate options for future systems, and technology development needs. A new MILSATCOM architecture was begun to include the totality of DoD, satellite communications requirements over the next twenty years. The extent of the new architecture formulated to date identifies the enhancement of the AFSAT/FLTSAT, DSCS III and the Satellite Data System (SDS) systems including a new satellite system (MILSTAR) for the accommodation of the strategic and tactical forces, needs in the late 1980s.

2. FY 1982 Planned Program: Emphasis will be placed on defining the MILSTAR system for incorporation into the existing MILSATCOM architecture. Studies will be conducted to identify alternatives for transitioning to the objective system by focusing on requirements and technology. Emphasis on the User Requirements Data Base (URDB) as the mechanism for identifying, analyzing and processing requirements will be continued. The Technology Development Program Plan will be updated to reflect technological advances. Studies supporting survivability, endurance, and control will be initiated. Near term UHF/SHF system improvement will also be developed.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: 4000
Program Element: #33126K
DoD Mission Area: Common-User Communications - #363

Title: Military Satellite Communications (MILSATCOM)
Title: Long-Haul Communications - DCS
Budget Activity: #5 Intelligence & Communications

3(U)FY 1983 Planned Program: The MILSATCOM Systems Architecture developed in FY 1981 and expanded in FY 1982 will be updated to correspond with the results of studies undertaken in FY 1982 as well as to reflect funding authorizations. The FY 1982 enhancement of the URDB as an architectural tool, and the formulation of a resources data base will be used to support the architectural updating effort. The Five-Year MILSATCOM Program Plan will be updated as will the Twenty-Year MILSATCOM Architecture Plan. Increased emphasis will be placed on developing transition plans from the current systems to the objective systems of MILSTAR, DCSC III, etc.

4(U)FY 1984 Planned Program: The MILSATCOM architecture will be reviewed and revised as required. The URDB will be updated, the 5-year, 20-year, and Technology Development Program Plans will be reviewed and revised. Transition planning will continue. Advanced studies for concepts beyond MILSTAR will begin, and emphasis on survivability and endurance issues will be maintained.

5(U)Program to Completion: The MILSATCOM Systems Architecture will be continually updated to meet the dynamic needs of MILSATCOM users in an evolutionary manner consistent with technology, cost and risks. Continuing efforts will be pursued in the areas of system and technology developments that influence space and earth segment configuration design to provide an optimum cost effective mix to meet user requirements and improve mission success.

- 6.(U)Milestones: Publish Five-Year MILSATCOM Program Plan - FY 1982
URDB Revision complete - FY 1983
Publish Twenty-Year MILSATCOM Architecture Plan - FY 1983
Revised edition of Technology Development Program Plan - FY 1983
Publish new MILSATCOM architecture - FY 1984

<u>Resources (\$ in thousands):</u>	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
RDT&E	2,068	1,867	2,682	3,049	3,124	3,229	3,422

FY 1983 RDT&E DESCRIPTIVE SUMMARY (U)

(U) Program Element: # 33127K Title Support of the NCS
 (U) DoD Mission Area Support & Base Communications #362

Budget Activity Intelligence & Communications - #5

A. (U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Costs
9020	TOTAL FOR PROG ELEMENT						
9020	Support of the NCS	0	*	1990	2960	Continuing	Continuing

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This project covers two of the National Security Telecommunications Policy (PD-53) initiatives approved by the National Security Council for implementation by the National Communications System (NCS). It involves the development of techniques that will

C. BASIS FOR FY 1983 RDT&E REQUEST During fiscal year 1983, the following actions will be taken:

- (1) Initiate and complete installation of and begin installation of for those locations (where deficiencies have been identified).
- (2) - Development of for future fiber optic transmission systems. Also, completion of the effort to

D. (U) COMPARISON WITH FY-82 DESCRIPTIVE SUMMARY Not applicable.

E. OTHER APPROPRIATION FUNDS

	FY 81	FY 82	FY 83	FY 84
Operation and Maintenance				
NCS TOTAL	7,972	27,145	34,376	29,919

* 450 UNDER PE 33126K

FY 1983 RDT&E DESCRIPTIVE SUMMARY (U)

(U) Program Element: # 33127K Title Support of the NCS
(U) DoD Mission Area: Support & Base Communications #362 Budget Activity Intelligence & Communications - #5

F. DETAILED BACKGROUND AND DESCRIPTION:

related technical initiatives being pursued by the Office of the Manager, NCS, in response to Presidential Directive 53, "National Security Telecommunications Policy". Its objectives are (1)

The related technical initiatives being pursued by the Office of the Manager, NCS, in response to PD-53. Its objectives are (1) determine the most cost effective means of protecting these facilities from future decisions regarding cost effectiveness of proposed fixes and (3) to (e.g., fiber optic transmission systems and terminal to network interfaces) to

G. (U) RELATED ACTIVITIES: Presidential Directive 53, stipulates that "... It is essential to the security of the United States to have telecommunications facilities adequate to satisfy the needs of the nation during and after any national emergency. Moreover, a survivable communications system is a necessary component of our deterrent posture for defense. ..." In response to PD-53, several initiatives are being pursued by the Office of the Manager, NCS, e.g., Class 4/5 Switch Study, Survivable Satellite Program, Network Management, Common Carrier Interconnect, and Policy Initiatives.

H. (U) WORK PERFORMED BY: AT&T

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 and Prior Accomplishments: None
2. (U) FY 1982 Program: \$450 funded under PE 33126K

FY 1983 RDT&E DESCRIPTIVE SUMMARY (U)

(U) Program Element: # 33127K Title Support of the NCS
(U) DoD Mission Area: Support & Base Communications #362

Budget Activity Intelligence & Communications - #5

3. FY 1983 Planned Program:

- a) Complete evaluation of fixes.
- b) Initiate and complete installation of fixes to
- c) Initiate installation of

- a) Award contract to AT&T for development of
- b) Complete

4. FY 1984 Planned Program:

Complete installation of

Complete formulation of fiber optic system design and maintenance practices.

5. (U) Program to Completion: CONTINUING

FY 1983 RDT&E DESCRIPTIVE SUMMARY (U)

(U) Program Element: # 33127K Title Support of the NCS

(U) DoD Mission Area: Support & Base Communications #362

Budget Activity Intelligence & Communications - #5

6. Milestones:

Complete Vulnerability Assessment	Sept 82
Complete Evaluation of Proposed Fixes	Jan 83
Installation	Mar 83 - Sept 83
Installation	Sept 83 - Apr 84
Identification/Test/Installation of	Sept 81 - Dec 84
Development of Fiber Optic Design and Maintenance	Sept 81 - Oct 83
Practices	
Award contract to AT&T for Development of	Mar 83
Installation of Fixes in Key Facilities	June 83 - Dec 87

FY 1983 RDT&E DESCRIPTIVE SUMMARY (U)

(U) Program Element: # 33127K Title Support of the NCS
(U) DoD Mission Area: Support & Base Communications #362

Budget Activity Intelligence & Communications - #5

7. (U) Resources:	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>	<u>FY 85</u>	<u>FY 86</u>	<u>FY 87</u>
(\$ in Thousands)	*	1990	2960	5000	5000	5000

J. (U) TEST AND EVALUATION DATA: Not Applicable.

1. (U) Development Test and Evaluation: Not Applicable.
2. (U) Operational Test and Evaluation: Not Applicable.
3. (U) System Characteristics: Not Applicable.

* 450 UNDER PE 33126K

Research, Development, Test, and Evaluation, Defense Agencies

DIA

21 JAN 82

Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:

Direct:

10 0001 Total

Financing:

Unobligated balance available, start of year:
 21.4001 For completion of prior year budget plans
 21.4002 Reprogramming from or to prior year budget plan
 24.4001 Unobligated balance available, end of year
 Unobligated balance available, end of year
 25.0001 Unobligated balance lapsing
 40.0001 Budget authority (appropriation)

Object Classification (in thousands of dollars)

Identification code	97-0400-0-1-051	1981 actual	1982 est.	1983 est.
<hr/>				
Other services:				
125.003	Contracts			
<hr/>				
999.901	Total obligations			

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE INTELLIGENCE AGENCY
RDT&E, DEFENSE AGENCY

SUMMARY BY BUDGET ACTIVITY
(IN THOUSANDS OF DOLLARS)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
5. Intelligence and Communications				
Total Program				

SUMMARY BY PROGRAM CATEGORY

3.1 Operational Systems Development

 Total Program

Research, Development, Test, and Evaluation, Defense Agencies

DIA

21 JAN 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
10.0001	Total						
Financing:							
Unobligated balance available, start of year:							
21.4001	For completion of prior year budget plans						
21.4002	Reprogramming from or to prior year budget plan						
25.0001	Unobligated balance lapsing						
40.0001	Budget authority (appropriation)						

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
10.0001	Total						
Financing:							
Unobligated balance available, start of year							
21.4001	Unobligated balance available, end of year						
24.4001							
40.0001	Budget authority (appropriation)						

Research, Development, Test, and Evaluation, Defense Agencies

DIA

21 JAN 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:							
Direct:							
10.0001	Total	.....		.....	.....
Financing:							
21.4001	Unobligated balance available, start of year	.....		.....	.....
24.4001	Unobligated balance available, end of year	.....		.....	.....

40.0001	Budget authority (appropriation)	.....		.....	.....

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:							
Direct:							
10.0001	Total	.....	.....		.....	.....
Financing:							
24.4001	Unobligated balance available, end of year	.....	.....		.....	.....

40.0001	Budget authority (appropriation)	.....	.....		.....	.....

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE INTELLIGENCE AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
PERFORMER DISTRIBUTION
(IN THOUSANDS OF DOLLARS)

Total Obligation Authority			
1981	1982	1983	1984

- | | | | | |
|--|--|--|--|--|
| 1. For operations of installations of the Defense Intelligence Agency
<u>Government operated</u> | | | | |
| 2. For operations of installations of the Defense Intelligence Agency
<u>Contractor operated</u> | | | | |
| 3. For contracts directly in support of work actually performed at
installations of the Defense Intelligence Agency | | | | |
| 4. For work assigned to other DoD activities | | | | |
| 5. For work assigned to activities of other Government agencies | | | | |
| 6. For work performed by industrial contractors | | | | |
| 7. For work performed by educational institutions: | | | | |
| a. <u>Designated Federal Contract Research Centers</u> | | | | |
| b. <u>Other institutions</u> | | | | |
| 8. For work performed by other "non-profit" organizations: | | | | |
| a. <u>Designated Federal Contract Research Centers</u> | | | | |
| b. <u>Other institutions</u> | | | | |
| 9. Total R&D Appropriation | | | | |

DEPARTMENT OF DEFENSE - MILITARY
 DEFENSE INTELLIGENCE AGENCY
 SUMMARY OF FEDERAL CONTRACT RESEARCH CENTERS BY APPROPRIATION AND PROGRAM
 (DOLLARS IN THOUSANDS)

	<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>	<u>FY 84</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>
3.13.01.L				
Total				
3.13.01.L				
3.13.01.L LANTCOM V&V				
3.13.01.L DoDIIS V&V				
Total				
3.13.01.L DoDIIS V&V				
3.13.01.L DoDIIS Networking				
Total				

Total Program Summary By Appropriation:

: 370 Total Federal Contract Research Centers

DEPARTMENT OF DEFENSE - MILITARY
 DEFENSE INTELLIGENCE AGENCY
 INSTALLATION ANALYSIS - FCRCS

Location	TOA (IN THOUSANDS OF DOLLARS)								PERSONNEL							
									Professional				Support			
				1/ All					Paid				Paid			
	Mgmt	Other	Other		Sub	Mil.	Pers		From	Paid			From	Paid		
	Parent	Parent	Other						Parent	From	Paid		Parent	From	Paid	Mil.
	Dept	Dept	DoD	Funds	Total	RDT&E	Other	Total	Dept	Other	From		Dept	Other	From	Pers
	FY	Agency	Dept	DoD	Funds	Total	RDT&E	Other	Total	RDT&E	RDT&E	Other	RDT&E	RDT&E	Other	Assigned
																Total

Remarks:

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE INTELLIGENCE AGENCY
 RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
 PROGRAM ELEMENT LISTING

(Dollars in Thousands)

		<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
5. Intelligence and Communications					
<u>Element Code</u>	<u>Project No.</u>				
3.1	<u>Operational Systems</u>				
	<u>Development</u>				
	<u>Title</u>				
3.13.01.L	<u>General Defense Intelligence</u>				
	<u>Program</u>				

ADDITIONAL JUSTIFICATION MATERIAL FOR THE DEFENSE INTELLIGENCE AGENCY
PROGRAMS IS CONTAINED IN THE GENERAL DEFENSE INTELLIGENCE PROGRAM SECTION
OF THE NATIONAL FOREIGN INTELLIGENCE PROGRAM CONGRESSIONAL BUDGET
JUSTIFICATION BOOKS WHICH ARE AVAILABLE AT A HIGHER CLASSIFICATION
AND REQUIRE SPECIAL ACCESS

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Research, Development, Test, and Evaluation, Defense Agencies

DMA

08 FEB 82

Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:

Direct:

5.	Intelligence and communications	20,148
	Reimbursable program	6,179

10.0001	Total	26,327
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Financing:

	Offsetting collections from:	
11.0001	Federal funds	-6,179
21.4001	Unobligated balance available, start of year
24.4001	Unobligated balance available, end of year	.....
40.0001	Budget authority (appropriation)	20,148

Direct obligations:

Other services:

125.003	Contracts	5,397
125.004	Other	14,751
199.001	Total direct obligations	20,148

Reimbursable obligations:

Other services:

225.003	Contracts	4,375
999.901	Total obligations	24,523

374-blank

DEPARTMENT OF DEFENSE, MILITARY
DEFENSE MAPPING AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
SUMMARY BY BUDGET ACTIVITY

(\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
1. Technology Base	-	-	-	-
2. Advanced Technology Development	-	-	-	-
3. Strategic Programs	-	-	-	-
4. Tactical Programs	-	-	-	-
5. Intelligence & Communications	20,148			
6. Defensewide Mission Support	-	-	-	-
TOTAL RDT&E - DIRECT	20,148			
Reimbursements	6,179	5,000	5,000	5,000
TOTAL PROGRAM	26,327			

DEPARTMENT OF DEFENSE, MILITARY
DEFENSE MAPPING AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
SUMMARY BY PROGRAM CATEGORY

(\$ in Thousands)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
6.1 Research	-	-	-	-
6.2 Exploratory Development	-	-	-	-
6.3 Advanced Development	14,265	16,000	17,863	18,584
6.4 Engineering Development	5,883	6,034	10,082	12,667
6.5 Management and Support	-	-	-	-
Total Research and Development (Program 6)	20,148	22,034	27,945	31,251
Total Operational Systems Program	-	-	-	-
Total Intelligence & Communications (Program 3)	-			
Total RDT&E - Direct	20,148			
Reimbursements	6,179	5,000	5,000	5,000
TOTAL PROGRAM	26,327			

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Research, Development, Test, and Evaluation, Defense Agencies

DMA

08 FEB 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:							
Direct:							
10.0001	Total	.....	.....	.....	151	.....	.....
Financing:							
21.4001	Unobligated balance available, start of year	-151

40.0001	Budget authority (appropriation)

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Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:							
Direct:							
5.	Intelligence and communications	20,148	.....	.....	20,148	.....	.....
	Reimbursable program	6,179	.....	.....	4,224	1,955	.....
		-----	-----	-----	-----	-----	-----
10.0001	Total	26,327	.....	.....	24,372	1,955	.....

Financing:							
Offsetting collections from:							
11.0001	Federal funds	-6,179	.....	.....	-6,179	.....	.....
21.4001	Unobligated balance available, start of year	.....	.....	.....	.....	-1,955	.....
24.4001	Unobligated balance available, end of year	1,955
		-----	-----	-----	-----	-----	-----
40.0001	Budget authority (appropriation)	20,148	20,148

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Research, Development, Test, and Evaluation, Defense Agencies

DMA

08 FEB 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:

Direct:

5. Intelligence and communications
Reimbursable program

10.0001 Total

Financing:

Offsetting collections from:

- 11.0001 Federal funds
21.4001 Unobligated balance available, start of year
24.4001 Unobligated balance available, end of year

40.0001 Budget authority (appropriation)

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Research, Development, Test, and Evaluation, Defense Agencies

DMA

08 FEB 82

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:

Direct:

5. Intelligence and communications
Reimbursable program

10.0001 Total

Financing:

Offsetting collections from:

- 11.0001 Federal funds
24.4001 Unobligated balance available, end of year

40.0001 Budget authority (appropriation)

379

DEPARTMENT OF DEFENSE, MILITARY
DEFENSE MAPPING AGENCY
PERFORMER DISTRIBUTION
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

(Thousands of Dollars)

Date: 21 January 1982

Appropriation: RDT&E, Defense Agencies

	Total Obligation Authority			
	FY 1981	FY 1982	FY 1983	FY 1984
1. For operation of installations of the reporting DoD Component <u>Government operated</u>				
2. For operation of installations of the reporting DoD Component <u>Contractor operated</u>				
3. For contracts <u>directly in support</u> of work actually performed at installations of the reporting DoD Component				
4. For work assigned to other Department of Defense activities				18,575
5. For work assigned to activities of other Government agencies				
6. For work performed by industrial contractors ("profit" organizations)	517	745	955	1,076
7. For work performed by educational institutions				
a. <u>Designated Fed Contract Res Centers</u>	-	-	-	-
b. <u>Other Institutions</u>	931	1,043	1,095	1,150

DEPARTMENT OF DEFENSE, MILITARY
DEFENSE MAPPING AGENCY
PERFORMER DISTRIBUTION
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

(Thousands of Dollars)

Date: 21 January 1982

Appropriation: RDT&E, Defense Agencies (Cont'd)

		Total Obligation Authority			
	FY 1981	FY 1982	FY 1983	FY 1984	
8. For work performed by other "non-profit" organizations					
a. <u>Designated Fed Contract Res Centers</u>	125	175	125	125	
b. <u>Other Institutions</u>					
9. Total RDT&E Appropriation	20,148				

DEPARTMENT OF DEFENSE, MILITARY
DEFENSE MAPPING AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
FEDERAL CONTRACT RESEARCH CENTERS
SUMMARY BY APPROPRIATION/PROJECT

UNCLASSIFIED

(\$ in Thousands)

(THIS EXHIBIT IS UNCLASSIFIED)

AEROSPACE CORPORATION

Research, Development, Test and Evaluation

6.37.01.B Mapping, Charting and Geodesy

Investigations and Prototype

Development

TOTAL RDT&E

REMARKS: For investigations, tests and analysis
of advanced positioning techniques in
support of national level programs.

Total Aerospace Corporation

<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>
<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>

	125	175	125	125
	125	175	125	125

	125	175	125	125
--	-----	-----	-----	-----

TOTAL PROGRAM SUMMARY BY APPROPRIATIONS

Research, Development, Test and Evaluation

Operations and Maintenance

Total Federal Contract Research Centers

(In-House Effort)

Subcontract Effort Excluded from this Amount

	125	175	125	125
	0	0	0	0
	125	175	125	125
	0	0	0	0

UNCLASSIFIED

DEPARTMENT OF DEFENSE, MILITARY
DEFENSE MAPPING AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
INSTALLATION ANALYSIS - FEDERAL CONTRACT RESEARCH CENTERS

(THIS EXHIBIT IS UNCLASSIFIED)

TOA (\$ in Thousands)									PERSONNEL (Man-Years)											
Federal Contract Research Center and Location								Professional			Support									
	RDT&E Funds				All Other Funds	Sub- Total	Mil Pers	Total	Paid From Parent Dept	Paid From Other RDTE	Paid From Other	Paid From Parent Dept	Paid From Other RDTE	Paid From Other	Mil Assigned	Total				
	FY	Agency	Parent Dept	Other DoD					RDTE	RDTE	RDTE	RDTE	RDTE	RDTE	RDTE	RDTE	RDTE	RDTE	RDTE	RDTE
Aerospace Corp., Los Angeles, CA	81	125	--	--	--	125	--	125	1	--	--	--	--	--	--	--	1			
	82	175	--	--	--	175	--	175	1	--	--	--	--	--	--	--	1			
	83	125	--	--	--	125	--	125	1	--	--	--	--	--	--	--	1			
	84	125	--	--	--	125	--	125	1	--	--	--	--	--	--	--	1			
Total Federal Contract Research Center	81	125	--	--	--	125	--	125	1	--	--	--	--	--	--	--	1			
	82	175	--	--	--	175	--	175	1	--	--	--	--	--	--	--	1			
	83	125	--	--	--	125	--	125	1	--	--	--	--	--	--	--	1			
	84	125	--	--	--	125	--	125	1	--	--	--	--	--	--	--	1			

DEPARTMENT OF DEFENSE, MILITARY
DEFENSE MAPPING AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
DETAILS BY BUDGET ACTIVITY

(\$ in Thousands)

<u>Element Code</u>	<u>Project No.</u>	<u>Title</u>	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>	<u>Descriptive</u> <u>Summary</u> <u>Page No.</u>
5. <u>Intelligence & Communications</u>							
			-				385
		Subtotal,	-				
6.3A <u>ADVANCED DEVELOPMENT</u>							
6.37.01.B		<u>MC&G INVESTIGATIONS AND</u> <u>PROTOTYPE DEVELOPMENT</u>	14,265	16,000	17,863	18,584	386
		Subtotal, Advanced Development Category	14,265	16,000	17,863	18,584	
6.4 <u>ENGINEERING DEVELOPMENT</u>							
6.47.01.B		<u>MC&G DEVELOPMENT ENGINEERING</u> <u>AND TESTS</u>	5,883	6,034	10,082	12,667	400
		Subtotal, Engineering Development Category	5,883	6,034	10,082	12,667	
		TOTAL, Intelligence & Communications	20,148				

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #

Title: Defense Mapping Agency (DMA) Support

DoD Mission Area: # 321

(U) Budget Activity: # 5 - Intelligence & Communications

A. RESOURCES: (\$ in Thousands).

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>	<u>Additional to</u> <u>Completion</u>	<u>Total Estimated</u> <u>Cost</u>
TOTAL FOR PROGRAM ELEMENT	-				Continuing	N/A

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED.

C. BASIS FOR FY 1983 RDT&E REQUEST.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY.

E. OTHER APPROPRIATION FUNDS.

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>
Procurement				
O&M				

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JUSTIFICATION OF ESTIMATES FOR FISCAL YEAR 1983 SUBMITTED TO CO--ETC(U)
FEB 82

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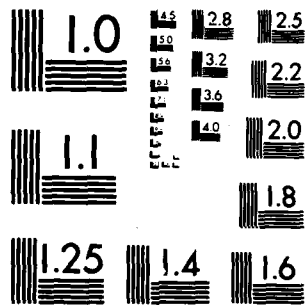
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AD-A21 642 OFFICE OF THE SECRETARY OF DEFENSE WASHINGTON DC F/G 5/1
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FEB 82

$$A_{\text{eff}} = \frac{A}{1 + \frac{A}{A_0}} = \frac{A}{1 + \frac{A}{A_0}}$$

■



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(THIS SUMMARY IS UNCLASSIFIED)

Program Element: # 63701B

Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development

DoD Mission Area: # 321

Budget Activity: # 5 - Intelligence & Communications

A. RESOURCES (PROJECT LISTING): (\$ in Thousands).

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	<u>TOTAL FOR PROGRAM ELEMENT</u>	<u>14265</u>	<u>16000</u>	<u>17863</u>	<u>18584</u>	<u>Continuing</u>	<u>N/A</u>
3201	Data Collection	3749	3906	7253	6631		
3202	Photogrammetric Exploitation	2071	2303	1919	2627		
3203	Cartographic Exploitation	1928	4864	3327	2738		
3204	Geodetic and Geophysical Support	1563	2354	2282	3034		
3205	Data Base/Data Bank	4358	2273	2797	3259		
3206	Products and Services	591	300	285	295		

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED. DMA's primary mission is to support the Military Services by providing MC&G products and services that are critical to successful military operations. The current projects in this element are designed primarily to (1) develop new processes, techniques and prototype equipment required for transition to a total DMA Digital/Softcopy Production System and (2) to improve the existing DMA production system to meet current and on-going DoD MC&G requirements during the transition period.

C. BASIS FOR FY 1983 RDT&E REQUEST. The DMA program for FY 1983 will continue to be directed toward developing and maintaining MC&G capabilities required to satisfy increasing and more stringent requirements critical to DoD weapons and control systems, such as the MX, Trident, Pershing II and Cruise Missile Systems, including further development of prototype components of the DMA Digital Production System. The program request provides for the development of a more effective and efficient production operation in meeting DMA's current and future responsibilities and will permit the continuous exploitation of the more promising technological developments. The above cost estimate data are expressed in current dollars which include cost escalations for the budget and outyears.

Program Element: # 63701B (Cont'd)

Title: Mapping, Charting and Geodesy (MC&G)

Investigations and Prototype Development

DoD Mission Area: # 321

Budget Activity: # 5 - Intelligence & Communications

D. COMPARISON WITH FY 82 DESCRIPTIVE SUMMARY. There is a net increase of \$3.2 million in the above cost estimates for FY 1983 as compared to the same data in the FY 1982 Descriptive Summary. The increase results from additional geodetic and geophysical activities required in support of advanced weapons systems and to provide needed acceleration in major prototype components for the DMA Digital Production System.

E. OTHER APPROPRIATION FUNDS. N/A

Project: #3201
Program Element: # 63701B

DoD Mission Area: # 321

Title: Data Collection
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

F. DETAILED BACKGROUND AND DESCRIPTION. The collection of MC&G data by sensors and instruments mounted in aerospace vehicles and surface ships as well as those used on land is a matter of continuing serious concern. The magnitude of the collection tasks plus the demand for increased accuracy and area coverage to meet the requirements of new and improved weapons systems makes a comprehensive R&D effort necessary. The current R&D program continues various developments in all aspects of aerospace, land and sea data collection activities. Within the functional areas of Gravity, Hydrographic and Positional data collection are such subtasks as a Global Positioning System Receiver development for improved positioning; a hydrographic airborne laser system for depth determination in coastal waters; a gradiometry analysis for developing practical techniques for improving the usefulness of moving base gravity gradiometers; a passive/active airborne bathymetry data collection system using a multispectral scanner with laser calibrations; and analyses of the Geodetic Positioning System to obtain accurate and efficient geodetic measurements.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency, (DMA) as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. Naval Ocean Research and Development Activity, Bay St. Louis, Mississippi; Naval Sea Systems Command, Washington, D.C.; and Air Force Geophysics Laboratory, Hanscom AFB, Massachusetts.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. Prior completions include a Bottom Topography Survey Subsystem (BOTOSS lightweight bottom survey system for use on various types of survey ships), a laser sounder receiver and bandwidth reduction system, a special data reduction task for the hydro airborne laser sounder system, an aircraft geophysical sensor suite to improve gravity data collection, various Global Positioning System (GPS) package developments and an acoustic seamount reconnaissance task to demonstrate the feasibility of using scattered acoustic energy for hydrographic surveying systems.

2. FY 1982 Program. During FY 1982, the following efforts will continue; a hydrographic airborne laser sounder system (HALS) for collecting depth data in coastal waters without the use of photography; a system for automatic determination of astronomical azimuths to improve positioning; various GPS related activities to improve geodetic positioning in the continental United States and elsewhere; a gradiometry analysis and test and an active/passive bathymetry task as described above in paragraph F; and a coastal hydrographic sonar task to increase the productivity of the Navy's hydrographic survey launches.

Project: # 3201 (Cont'd)
Program Element: # 63701B

DoD Mission Area: # 321

Title: Data Collection

Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development

Budget Activity: # 5 - Intelligence & Communications

3. FY 1983 Planned Program. During FY 1983, development activities described in FY 1982 will continue. New initiatives will include an advance survey development effort to provide geodetic positioning data in support of advanced weapons systems.

4. FY 1984 Planned Program. All items described in the FY 1983 planned program will be continued.

5. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION DATA. N/A

Project: # 3202
Program Element: # 63701B

DoD Mission Area: # 321

Title: Photogrammetric Exploitation
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

F. DETAILED BACKGROUND AND DESCRIPTION: MC&G source data acquired by various types of sensors (multi-spectral, RADAR, etc.) are received in a variety of sizes, shapes and media with varying degrees of geometric distortions and image fidelity. Also, the massive quantity of data generated during the reduction processes requires investigation on the application of new computer technology to photogrammetric processing. The objective of this project is to develop prototype automated equipments, techniques, and software to improve current capabilities or to provide new capabilities to expeditiously process and accurately reduce these acquired data in usable form for the production of MC&G products. The various work efforts within the project address the following basic functional areas: photographic and photogrammetric processing, mensuration, adjustment and transformation. Photogrammetric techniques are used to derive accurate terrain as well as other natural and cultural feature portrayals, geodetic control data and undistorted photographic renditions. Such subtasks as digital rectifiers, radargrammetric triangulation, and a digital stereo image processing system are illustrative of efforts directed at the development objective.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia; U.S. Air Force Rome Air Development Center, Griffiss AFB, Rome, N.Y.; and the Naval Ocean Research and Development Activity, Bay St. Louis, Mississippi.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. Completions during FY 1981 and prior years include a study to assess radar for MC&G applications, a project to extract elevation data more accurately and efficiently, remote sensing assessment of terrain data, microprogramming hardware applications to enhance the computational capabilities and productivity of data acquisition systems.

Project: # 3202 (Cont'd)
Program Element: # 63701B

DoD Mission Area: # 321

Title: Photogrammetric Exploitation
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

2. FY 1982 Program. During FY 1982, the following efforts will continue: a project to provide DMA with the capability to perform map and chart revisions, feature analyses and extractions using newly developed rectification systems; a remote sensor exploitation task to develop techniques for locating and positioning hydrographic hazards and to provide accurate and reliable water depth information for use in survey planning and chart revisions; a synthetic aperture radar (SAR) simulation triangulation project to develop the mathematics and related software programs to block adjust SAR sensor materials collected in various configurations; a task to design, develop, test and implement a digital image restoration and manipulation capability in the interactive Remote Work Processing Facility (RWPF) at DMA's Production Centers; and a multi-sensor hydrographic exploitation task to develop and refine high potential hydrographic remote sensor technologies for incorporation in DMA's production processes.

3. FY 1983 and FY 1984 Planned Programs. With the exception of the developments to be completed, all of the items described in the FY 1982 program will continue during this period.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION. N/A.

Project: #3203
Program Element: # 63701B

Title: Cartographic Exploitation
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

F. DETAILED BACKGROUND AND DESCRIPTION. Increasing demands for varied MC&G products and data unique to specific weapons and command and control systems necessitate not only a rapid and flexible production capability, but also the capability to generate, select, convert and manipulate MC&G data in digital form. Digital data satisfies the unique requirements of many weapon systems and is also suited to automation of cartographic processes. This project consists of efforts leading to the development of prototype equipment, techniques, and software that address the automated functions of compilation, transformation, proofing and editing, plotting, and graphic arts.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia; U.S. Air Force Rome Air Development Center, Griffiss AFB, Rome, New York; and Naval Ocean Research and Development Activity, Bay St. Louis, Mississippi.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. During this period, completions included a limited quantity color reproduction task to provide for rapid color reproduction of maps at less cost than lithography, a digital terrain elevation data exploitation task to develop advanced graphic displays for digital land mass simulation (DLMS) elevation data stored in a polynomial model format, and an electron beam recorder/plotter for data base uses as well as outputting final graphic reproduction plates.

2. FY 1982 Program. During FY 1982, continuations include a task to develop printing equipment for direct imaging to paper from on-line computer input; an automated cartography processing system using an associative array processor to increase the speed of various operations; a clustered cartographic processing system to provide the most effective integration of equipment, hardware and software and to provide optimum production throughput; an automated cartography feature identification system which will tag features which have been collected for raster scanning; an integrated automated cartography task to define system architecture which integrates the separate components into an effective network with or without a mainframe computer; a geographic names type file task to enable rapid type retrieval and storage; and an optical character recognition task to automatically read and digitize alpha-numeric characters; and a state of the art feature analysis project which consists of various efforts designed to upgrade existing MC&G equipment and algorithms for prototype production systems.

Project: # 3203 (Cont'd)
Program Element: # 63701B

DoD Mission Area: # 321

Title: Cartographic Exploitation
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

3. FY 1983 and FY 1984 Planned Programs. During this period, all of the items described in the FY 1982 program will continue with the exception of the geographic names type file projects which will be completed by the end of FY 1982.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION. N/A.

Project: # 3204
Program Element: # 63701B

DoD Mission Area: # 321

Title: Geodetic and Geophysical Support (G&G)
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

F. DETAILED BACKGROUND AND DESCRIPTION. User requirements for geodetic and geophysical support are constantly increasing with an attendant requirement to improve the accuracy of current maps, charts and other products. Further, emerging weapons systems, especially those incorporating inertial guidance or navigation systems, require more detailed and accurate geodetic and gravimetric data over larger areas of the earth than do the current family of weapons. Development of rapid and economical methods of satisfying these requirements must significantly precede weapons systems developments to prevent geodetic and geophysical limitations on system CEP (circular error probable) and flexibility. Within the functional areas of position and gravity determination are such subtasks as software and studies concerning satellite to satellite tracking to support improved positioning; a satellite altimetry task to analyze satellite data with a view toward an improved altimeter; and a gravity sensor analysis to develop an optimum integration method for combining all available geodetic data (gradiometry, gravimetry, satellite altimetry, etc.,) for weapons support system development.

G. RELATED ACTIVITIES. Defense Research Sciences Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia; Naval Surface Weapons Center, Dahlgren, Virginia; U.S. Naval Oceanographic Office, Bay St. Louis, Mississippi; and Air Force Geophysics Laboratory, Hanscom AFB, Massachusetts.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. During FY 1981 and prior years, completions included a geomagnetic field data survey of DoD current and future requirements and data collection technology; an analysis of GEOS-3 altimetry data to determine the feasibility of using satellite radar altimetry data to define topographic elevations; a magnetic survey temporal variation study to develop and evaluate an optimum technique for determining and correcting errors produced by the temporal variations of the magnetic field during survey operations; and a scalar magnetic survey improvement task to develop new survey techniques and software to collect, process and display magnetic data.

Project: # 3204 (Cont'd)
Program Element: # 63701B

Title: Geodetic and Geophysical Support (G&G)
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

2. FY 1982 Program. During FY 1982, continuations will include a Global Positioning System (GPS) ephemeris development task for improved modeling technique and geodetic positioning; a GPS package to develop a real-time onboard orbit determination and prediction capability for low altitude satellites; a satellite radar altimetry task to minimize the hazards to submarine navigation caused by the presence of seamounts; a gravity sensor analysis to directly support critical requirements for gravity gradiometry, oceanic geoid and an improved earth gravity model; a task to demonstrate the field operation of a transportable two-color refractometer system for precise astronomic positioning; and efforts to explore the geodetic potential of using VLBI (Very Long Baseline Interferometry) for relative position determination between very widely separated sites.

3. FY 1983 and FY 1984 Planned Programs. During this period, all of the items described in the FY 1982 program will continue with the exception of the satellite radar altimetry effort which will be completed by the end of FY 1983.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION DATA. N/A.

Project: # 3205
Program Element: # 63701B

DoD Mission Area: # 321

Title: Data Base/Data Bank
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

F. DETAILED BACKGROUND AND DESCRIPTION. The large number of maps and charts currently in inventory is expensive to store and maintain up to date. Development of computer controlled storage of digital data and miniature maps with the objective of reducing the volume of maps and costs of updating will continue for several years. Additionally, the user requirements for many and varied graphic and digital products dictate new methods of formatting, storing, and retrieving the high volume of new source material necessary for MC&G production to satisfy these requirements. Within the functional areas of Methodology, Management, Computation, Storage and Retrieval and Dissemination, are subtasks such as a mass graphic storage and retrieval system to provide a micro-image recording and regeneration system to reduce volume and provide rapid retrieval; digital data management systems to assure effective control of digital data; an interactive digital facility development to add mass storage capability and high speed interfaces with an existing image processing facility; and a MC&G knowledge domain development to build a digital data base library containing spectral, spatial, environmental and planimetric signatures for MC&G features.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia; U.S. Air Force Rome Air Development Center, Griffiss AFB, Rome, New York; and the Defense Advanced Research Projects Agency, Arlington, Virginia.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. During this period, completions included lithographic scanning techniques to support total extraction of cartographic data from lithographic map products; the mass storage and retrieval system; recording media archival attributes which evaluated the long term storage characteristics of magnetic recording media for mass storage of digital data; a raster processing technique which minimizes conversion requirements associated with the use of raster scanning and plotting terminals; the development of photometrically calibrated black and white photography statistics for application to feature extraction problems; a processing subsystem integration task to provide an agencywide operational production information dissemination system; and data base storage plate development to provide a high performance projection printer for imaging selected photographic image points on film or glass at contact or reduced scales.

2. FY 1982 Program. During FY 1982, the following efforts will continue: an interactive digital facility development to add mass storage capability and high speed interfaces to an existing image processing facility and to serve as a test bed in determining specifications for DMA systems; the MC&G knowledge domain development described in Paragraph F. above;

Project: # 3205 (Cont'd)
Program Element: # 63701B

Title: Data Base/Data Bank
Title: Mapping, Charting and Geodesy (MC&G)
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

FY 1982 Program, Continued.

an optical disk technology task to analyze requirements and implement an advanced development model for use in the universal rectifier system (currently under development) and to handle DLMS (Digital Land Mass System) data; a MC&G data base system task to provide a capability to support multi-product generation at a minimum life cycle cost; and a task to support the development of a system definition and functional specifications for the DMA Digital/Softcopy Production System.

3. FY 1983 and FY 1984 Planned Programs. During this period, all efforts described in the FY 1982 program will be continued.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION DATA. N/A.

3206

Element: # 63701B

Title: Products and Services

Title: Mapping, Charting and Geodesy

Investigations and Prototype Development

Budget Activity: # 5 - Intelligence & Communications

on Area: # 321

LED BACKGROUND AND DESCRIPTIONS: This project provides for the development of new products and services, including techniques and devices for their production. With the development of new guidance and navigational systems for advanced and sea weapon systems, compatible products portraying earth positions, topographic data and ocean floor features are required. Accordingly, capabilities must be developed to provide essential data in a format that will assure the most effective interfacing of resources, data portrayal and weapon systems. Directed at the development of products requiring line graphic and photographic imagery portrayals are such development work efforts as Sensor Image Simulation (an image device that will provide an output for editing digital land mass data base and reviewing synthesized sensor images), and an advanced weapon system image simulation project to evaluate the suitability of DMA digital data at high resolution infrared sensor simulation.

ED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia; U.S. Air Force Rome Air Development Center, Griffiss AFB, New York; and the Aerospace Corporation, Los Angeles, California.

AM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

Y 1981 and Prior Accomplishments. During FY 1981, the first phase of the work effort on the advanced weapons system image simulation was completed. The results described what descriptors must be added to the DMA data base in order to simulate low level light TV and radar sensor imagery. The second phase of this effort will be performed in FY 1982.

Y 1982 Program. During FY 1982, the following efforts will continue: the sensor image simulation and the advanced weapons system tasks described in paragraph F. above and a data base development to assess the utility of digital land mass (LMS) data for producing visual simulation scenes.

Project: # 3206 (Cont'd)
Program Element # 63701B

DoD Mission Area: # 321

Title: Products and Services
Title: Mapping, Charting and Geodesy
Investigations and Prototype Development
Budget Activity: # 5 - Intelligence & Communications

3. FY 1983 and FY 1984 Planned Programs. During this period, program efforts described in FY 1981 will continue.
4. Program to Completion. This is a continuing program.
- J. TEST AND EVALUATION DATA. N/A.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(THIS SUMMARY IS UNCLASSIFIED)

Program Element: # 64701B

Title: Mapping, Charting and Geodesy (MC&G)

DoD Mission Area: # 321

Engineering Development and Test

Budget Activity: # 5 - Intelligence & Communications

A. RESOURCES (PROJECT LISTING): (\$ in Thousands).

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	<u>TOTAL FOR PROGRAM ELEMENT</u>	5883	6034	10082	12667	<u>Continuing</u>	<u>N/A</u>
4301	Data Collection	1059	57	43	58		
4302	Photogrammetric Exploitation	2221	2555	6264	8321		
4303	Cartographic Exploitation	376	2271	2605	2830		
4304	Geodetic and Geophysical Support	307	309	490	393		
4305	Data Base/Data Bank	128	176	260	603		
4306	Products and Services	792	666	420	462		

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: DMA's primary mission is to support the Military Services by providing MC&G products and services that are critical to successful military operations. The current projects in the element provide for the engineering development and testing of materiel to be used in the future DMA Digital Production System in addition to current production operations. Further, this element provides necessary follow-on engineering development of systems and equipment originating in Program Element 63701B.

C. BASIS FOR FY 1983 RDT&E REQUEST: The DMA program for FY 1983 will continue to be directed toward developing and maintaining MC&G capabilities required to satisfy increasing and more stringent requirements critical to DoD weapons and control systems, such as the MX, Trident, Pershing II and Cruise Missile Systems, including further development of prototype components of the DMA Digital Production System. The program request provides for the development of a more effective and efficient production operation in meeting DMA's current and future responsibilities and will permit the continuous exploitation of the more promising technological developments. The above cost estimate data are expressed in current dollars which include cost escalations for the budget and outyears.

Program Element: # 64701B (Cont'd)

Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test

DoD Mission Area: # 321

Budget Activity: # 5 - Intelligence & Communications

D. COMPARISON WITH FY 82 DESCRIPTIVE SUMMARY. There is a net increase of \$2.4 million in the cost data estimate for 1983 as compared to this estimate in the FY 82 Descriptive Summary. The increase is primarily attributed to a greater amount of engineering development activity than originally anticipated in the photogrammetric exploitation project.

E. OTHER APPROPRIATION FUNDS. N/A

Project: # 4301
Program Element: #64701B

Title: Data Collection
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

F. DETAILED BACKGROUND AND DESCRIPTION. The collection of MC&G data by sensors and instruments mounted in aerospace vehicles and surface ships as well as those used on land is a matter of continuing serious concern. The magnitude of the collection tasks plus the demand for increased accuracy and area coverage to meet the requirements of new and improved weapons systems make a comprehensive R&D effort necessary. The current R&D program continues various developments in aerospace, land and sea data collection activities. This project provides for the engineering development and test of Data Collection subtasks originating in 6.3 Advanced Development. Within the functional areas of Gravity, Hydrographic and Positional Data Collection are such subtasks as the NAVPAC system for positional improvements through satellite technology and absolute gravity experiments to improve the accuracy of the absolute gravity reference system and the monitoring of time variations of gravity.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. Naval Ocean Research and Development Activity, Bay St. Louis, Mississippi; Naval Sea Systems Command, Washington, D.C.; and Air Force Geophysics Laboratory, Hanscom AFB, Massachusetts.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. FY 1981 and prior accomplishments include a transducer mount development task to determine the proper location for an echo sounder on a survey boat. This new location enables the boat to operate in rougher seas and at higher speeds thus providing an increased capability for survey accomplishment. Also completed was the NAVPAC system providing for positional improvements through satellite technology.

Project: # 4301 (Cont'd)
Program Element: # 64701B

Title: Data Collection
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

2. FY 1982 Program. During FY 1982, the absolute gravity experiments to improve the accuracy of the absolute gravity reference system will continue.

3. FY 1983 and FY 1984 Programs. The effort described in the FY 1982 program will continue in FY 1983 and FY 1984.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION DATA. N/A.

Project: # 4302
Program Element: # 64701B

Title: Photogrammetric Exploitation
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

F. DETAILED BACKGROUND AND DESCRIPTION. This project provides for progression into engineering development of those photogrammetric and associated systems, equipment or processes determined during the 6.3 development to be feasible and suitable to meet specific technical objectives. MC&G source data, acquired by various types of sensors, are received in a variety of sizes, shapes and media with varying degrees of geometric distortions and image fidelity. Also, the massive quantity of data generated during the reduction processes requires investigation on the application of new computer technology to photogrammetric processing. The objective of the project is to develop engineering models capable of processing and reducing acquired data into usable form for production of MC&G products.

G. RELATED ACTIVITIES. Defense Research Sciences and exploratory development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia; U.S. Air Force Rome Air Development Center, Griffiss AFB, Rome, New York; and Naval Ocean Research and Development Activity, Bay St. Louis, Mississippi.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. During this period, completions included hardware and software changes to the Replacement of Photographic Imagery Equipment (RPIE) to provide a capability for the rectification of source materials, to optimize operations and provide additional required capabilities. Also, several triangulation tasks were completed to provide a capability for establishing photogrammetric control without dependency on other source materials.

Project: # 4302 (Cont'd)
Program Element: # 64701B

DoD Mission Area: # 321

Title: Photogrammetric Exploitation
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

2. FY 1982 Program. Continuations during this period include an optical power spectrum analyzer to be used for pre-screening photography to assure that only high quality photography is introduced into the production processes; a photometric high resolution array scanner task to determine characteristics (speed, resolution, and number of gray shades discriminated) of such a scanner - this task was transferred from 6.3 development to this project; a task to upgrade various photogrammetric equipments; a universal rectifier to provide a capability to digitally rectify any source material; an elevation data edit terminal to provide an on-line, near-real-time evaluation and edit capability for automated elevation data gathering equipment; a digital stereo comparator/compiler (DSCC) development to replace aging automated equipment at DMA Production Centers; an interactive feature analysis task to provide a pilot digital system for the generation of a Tactical Terrain Analysis Data Base (TTADB) and derivative products; and an Advanced Image Digitizing System (AIDS) to develop a scanner capable of accepting very high resolution hardcopy imagery and of transforming the imagery into digital form.

3. FY 1983 and FY 1984 Planned Programs. All FY 1982 tasks will be continued in this period with the exception of the elevation data edit terminal task which will be completed by the end of FY 1982. The photometric high resolution array scanner task will be completed by the end of FY 1983.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION. N/A.

Project: # 4303
Program Element: # 64701B

Title: Cartographic Engineering
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: 2.2 - Intelligence & Communications

DoD Mission Area: # 321

F. DETAILED BACKGROUND AND DESCRIPTION. This project provides for the developmental progression of those efforts determined in previous phases to be suitable for engineering development. The objective is to develop an automated cartographic system by selectively automating portions of the cartographic production processes that will enable the Defense Mapping Agency (DMA) to be more responsive to Strategic and Tactical Forces' requirements for conventional and special purpose MC&G products and data.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency, as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia; U.S. Air Force Rome Air Development Center, Griffiss AFB, Rome, New York; and Naval Ocean Research and Development Activity, Bay St. Louis, Mississippi.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. FY 1981 and prior accomplishments included: an automated cartography hardware/software task to integrate new hardware and software into the production line automated cartography system; a cathode ray tube plot head to print names and symbols on map products; a raster symbol generator for generating cartographic symbols using array processing technology; an expanded grey scale capability of the Raster Finishing Plotters; a cartographic compilation and revision subsystem to assess source material, to extract information from that source material and to compile it into revised or new graphic products; a raster data process support system for high speed raster scanning and plotting terminals; an advanced interactive graphic editing system for use in the production of digital data for advanced weapons system and for automated cartography production purposes; and a raster automated cartographic system to provide DMA with a fully integrated raster processing system.

2. FY 1982 Program. Continuations during this period include a voice recognition task to aid cartographic analysts in the automated compilation of feature analysis data; a bathymetric data reduction system for application to the production of hydrographic charts; a terrain editing and software merging capability to provide software documentation and user techniques for merging and examining Digital Elevation Matrices (DEM) and planimetric data including feature and terrain analysis data; a source assessment system development to provide the capability to simultaneously overlay and evaluate graphic, photographic and digital data in optimizing product compilation; a carto compilation/revision system task which will introduce automation into the current manual cartographic compilation/revision work station; a software for automated cartography task to provide advanced capabilities for DMA's automated cartographic system; the development of an integrated

Project: # 4303 (Cont'd)
Program Element: # 64701B

DoD Mission Area: # 321

Title: Cartographic Exploitation
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

FY 1982 Program, Continued.

cartographic production operation at a DMA production Center; and the development of an advanced type placement and geographic names data base system to minimize manual methods in the preparation and correction of data at various stages of the cartographic process and to provide better partitioning of symbol and image management tasks.

3. FY 1983 and FY 1984 Planned Programs. During this period, all of the items described in the FY 1982 program will continue with the exception of the bathymetric data reduction and terrain editing capability tasks which will be completed by the end of FY 1982. Also, the software for automated cartography and the integrated cartographic production task will be completed by the end of FY 1983.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION. N/A.

Project: # 4304
Program Element: # 64701B

Title: Geodetic and Geophysical Support (G&G)
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

F. DETAILED BACKGROUND AND DESCRIPTION. User requirements for geodetic and geophysical support are constantly increasing with an attendant requirement to improve the accuracy of current maps, charts and other products. Further, emerging weapon systems, especially those incorporating inertial guidance or navigation systems, require more detailed and accurate geodetic and gravimetric data over larger areas of the earth than do the current family of weapons. Development of rapid and economical methods of satisfying these requirements must significantly precede weapons systems developments to prevent geodetic and geophysical limitations on system CEP (circular error probable) and flexibility.

G. RELATED ACTIVITIES. Defense Research Sciences and exploratory development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. Naval Surface Weapons Center, Dahlgren, Virginia; Air Force Geophysics Laboratory, Hanscom AFB, Massachusetts; U.S. Naval Oceanographic Office, Bay St. Louis, Mississippi; and U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. Prior years accomplishments include several tasks directed toward improving weapons systems CEP; e.g., an improved gravity modeling task; a collocation technique to provide an optimum gravity model utilizing different types of surface and satellite data; a technique for geoid determination without precise satellite orbits; and a rapid geodetic survey system to develop a capability for determining the deflection of the vertical with accuracy required to support advanced missile systems.

2. FY 1982 Program. During FY 1982, efforts will continue on an advanced adjustment and gravity prediction technique that will enable useful gravity predictions in inaccessible areas; high altitude gravity measurements for comparison with operational models of the earth's gravitational field; and test equipment for use in conjunction with the Global Positioning System (GPS).

3. FY 1983 and FY 1984 Programs. The efforts described in the FY 1982 program will be continued and completed in FY 1983-1984 timeframe.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION DATA. N/A

408

Project: #4305
Program Element: # 64701B

Title: Data Base/Data Bank
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

F. DETAILED BACKGROUND AND DESCRIPTION. The large number of maps and charts currently in inventory is expensive to store and maintain up to date. Development of computer controlled storage of digital data and miniature maps with the objective of reducing the volume of maps and cost of updating will continue for several years. Additionally, the user requirements for many and varied graphic and digital products dictate new methods of formatting, storing, and retrieving the high volume of new source material necessary for MC&G production to satisfy these requirements. Within the functional areas of Methodology, Management, Computation, Storage and Retrieval and Dissemination are subtasks such as a Structured Programming Applications System to introduce modern practices into the DMA system to achieve cost effective software production and control; and a mathematical model for storing terrain elevation data.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency, as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia and U.S. Air Force Rome Air Development Center, Griffiss AFB, Rome, New York.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. During FY 1981 and prior years, completions included terrain characteristics from remote sensors task which provided a digital capability to exploit remotely sensed data in the ultraviolet, visible and infrared bands. Models were also completed for developing product independent digital data structures, amenable to computer controlled assembly of digital product data; and a mathematical model for storing terrain elevation data.

2. FY 1982 Program. Efforts during FY 1982 will include the structured programming application system described in paragraph F above and providing remote work processing facility (RWPF) transition support for automatic feature extraction systems at DMA Production Centers.

3. FY 1983 and FY 1984 Planned Programs. The structured programming application system and the RWPF transition support projects will be continued and completed during this period. New initiatives will include the development of a rapid coordinate transformation system to speed up MC&G production computer throughput on coordinate conversions.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION DATA. N/A.

Project: # 406
Program Element: # 64701B

Title: Products and Services
Title: Mapping, Charting and Geodesy (MC&G)
Engineering Development and Test
Budget Activity: # 5 - Intelligence & Communications

DoD Mission Area: # 321

F. DETAILED BACKGROUND AND DESCRIPTION. This project provides for the development of new products and services, including methods, techniques and devices for their production. With the development of new guidance and navigational systems for advanced air, land and sea weapon systems, compatible products portraying earth positions, topographic data and ocean floor features are required. Accordingly, capabilities must be developed to provide essential data in a format that will assure the most effective interfacing of resources, data portrayal and weapon systems. Directed at the development of products requiring digital, line graphic and photographic imagery portrayals are such developmental work efforts as radar scene generation in support of the PERSHING II missile system, and a film strip generator task to provide a more efficient method for the production of aircraft cockpit displays.

G. RELATED ACTIVITIES. Defense Research Sciences and Exploratory Development programs are conducted by the Army, Navy and Air Force laboratories to support continuing evolutionary development of equipment and techniques. The Director, Defense Mapping Agency (DMA), as Program Manager for DoD Mapping, Charting and Geodesy, maintains cognizance of these programs to assure that efforts are directed toward valid capability development objectives and to preclude unwarranted duplication.

H. WORK PERFORMED BY. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia and U.S. Air Force Rome Air Development Center, Griffiss AFB, New York.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS.

1. FY 1981 and Prior Accomplishments. During this period, a film strip generator task was transferred to this project from 6.3 Advanced Development. This task is to develop a more efficient method for the production of aircraft cockpit visual displays. Also, for the radar scene generation work effort, the first phase of a transformation program was completed. This completion allows DMA to generate Pershing II reference scenes from DLMS (Digital Land Mass Simulations).

2. FY 1982 Program. During FY 1982, efforts will continue on the radar scene generation task described in paragraph F. above. The film strip generator task, described in paragraph F. above, will be completed by the end of the year. New initiatives will include the development of worldwide atlases of coastal water optical properties in support of HALS (Hydrographic Airborne Laser System) development.

3. FY 1983 and FY 1984 Planned Programs. During this period, the radar scene generation task will be continued.

4. Program to Completion. This is a continuing program.

J. TEST AND EVALUATION. N/A.

HESSLER
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Research, Development, Test, and Evaluation, Defense Agencies

DNA

08 FEB 82

Program and Financing (in thousands of dollars)

Identification code		Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
	1. Technology base	199,771	259,757	326,600	197,189	244,563	325,151	
	Reimbursable program	4,405	5,000	9,000	4,352	5,052	9,000	
10 0001	Total	204,176	264,757	335,600	201,541	249,615	334,151	
Financing:								
Offsetting collections from:								
11 0001	Federal funds	-1,407	-3,400	-5,000	-1,351	-3,400	-5,000	
13 0001	Trust funds	-2,998	-1,600	-4,000	-2,998	-1,600	-4,000	
	Unobligated balance available, start of year:							
21 4001	For completion of prior year budget plans				-618	-3,017	-18,159	
21 4002	Reprogramming from or to prior year budget plan	-180						
24 4001	Unobligated balance available, end of year				3,017	18,159	19,608	
25 0001	Unobligated balance lapsing	180			180			
40 0001	Budget authority (appropriation)	199,771	259,757	326,600	199,771	259,757	326,600	

R		Research, Development, Test, and Evaluation, Defense Agencies	DNA	08 FEB 82
r		Object Classification (in thousands of dollars)		
Location code	97-0400-0-1-051	1981 actual	1982 est	1983 est
Direct obligations:				
Personnel compensation:				
Full-time permanent		3,822	4,398	4,588
Other than full-time permanent		32		
Other personnel compensation		52	81	84
Total personnel compensation		3,906	4,479	4,672
Civilian personnel		370	459	481
Travel and transportation of persons		569	1,084	1,259
Transportation of things		95	442	946
Communications, utilities and other rent		1,085	1,079	1,115
Printing and reproduction		14	25	25
Other services:				
Contracts		136,959	145,408	216,981
Other		47,564	88,147	91,345
Supplies and materials		4,605	1,494	1,502
Equipment		2,022	1,946	6,825
Total direct obligations		197,189	244,563	325,151
		*****	*****	*****
Reimbursable obligations:				
Personnel compensation:				
Full-time permanent		74	200	230
Civilian personnel		8	20	23
Travel and transportation of persons		4	10	12
Transportation of things			3	3
Communications, utilities and other rent		24	75	90
Printing and reproduction		1	4	5
Other services:				
Contracts		4,189	4,567	8,445
Supplies and materials		36	148	167
Equipment		16	25	25
Total reimbursable obligations		4,352	5,052	9,000
		*****	*****	*****
Total obligations		201,541	249,615	334,151

DEFENSE NUCLEAR AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION

PERSONNEL SUMMARY

(THIS SUMMARY IS UNCLASSIFIED)

	FY 1981	FY 1982	FY 1983
Total RDT&E:			
Total number of full-time permanent positions	157	176	185
Total compensable workyears:			
Full-time equivalent employment	165	176	185
Full-time equivalent of overtime and holiday hours	1	2	2
Average ES salary		56,185	58,500
Average GS grade	9.7	9.6	9.4
Average GS salary	24,399	26,216	26,287
Average salary of ungraded positions	17,364	17,167	17,167

DEPARTMENT OF DEFENSE - MILITARY
 DEFENSE NUCLEAR AGENCY
 RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

SUMMARY BY BUDGET ACTIVITY
 (\$ in thousands)

(THIS SUMMARY IS UNCLASSIFIED)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
1. Technology Base	199771	259757	326600	357547
2. Advanced Technology Development	--	--	--	--
3. Strategic Programs	--	--	--	--
4. Tactical Programs	--	--	--	--
5. Communications and Electronics	--	--	--	--
6. Program-Wide Management and Support	--	--	--	--
Total RDT&E - Direct	199771	259757	326600	357547
Reimbursements	<u>4352</u>	<u>5000</u>	<u>9000</u>	<u>9100</u>
TOTAL PROGRAM	204123	264757	335600	366647

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE NUCLEAR AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

SUMMARY BY PROGRAM CATEGORY
(\\$ in thousands)

(THIS SUMMARY IS UNCLASSIFIED)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
6.1 Research	--	--	--	--
6.2 Exploratory Development	199771	259757	326600	357547
6.3 Advanced Development	--	--	--	--
6.4 Engineering Development	--	--	--	--
6.5 Management and Support	--	--	--	--
Total Research and Development (Program 6)	199771	259757	326600	357547
Total Operational Systems Program	--	--	--	--
Total RDT&E - Direct	199771	259757	326600	357547
Reimbursements	<u>4352</u>	<u>5000</u>	<u>9000</u>	<u>9100</u>
TOTAL PROGRAM	204123	264757	335600	366647

HESSLER
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Research, Development, Test, and Evaluation, Defense Agencies

DNA

08 FEB 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code 97-0400-0-1-051

Budget plan (amounts for
RDT&E actions programmed)

Obligations

1981 actual 1982 est. 1983 est. 1981 actual 1982 est. 1983 est.

Program by activities:

Direct:

1. Technology base
Reimbursable program

10.0001

Total

383

-1

382

Financing:

Offsetting collections from:

- 11.0001 Adjustment to prior year federal fund order
Unobligated balance available, start of year:
21.4001 For completion of prior year budget plans
21.4002 Reprogramming from or to prior year budget plan
25.0001 Unobligated balance lapsing

40.0001

Budget authority (appropriation)

56

-618

180

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code 97-0400-0-1-051

Budget plan (amounts for
RDT&E actions programmed)

Obligations

1981 actual 1982 est. 1983 est. 1981 actual 1982 est. 1983 est.

Program by activities:

Direct:

1. Technology base
Reimbursable program

10.0001

Total

199,771

4,405

204,176

196,806

4,353

201,159

2,965

52

3,017

Financing:

Offsetting collections from:

- 11.0001 Federal funds
13.0001 Trust funds
21.4001 Unobligated balance available, start of year
24.4001 Unobligated balance available, end of year

40.0001

Budget authority (appropriation)

-1,407

-2,998

3,017

199,771

-1,407

-2,998

3,017

199,771

-3,017

HESSLER
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Research, Development, Test, and Evaluation, Defense Agencies

DNA

08 FEB 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est	
Program by activities:								
Direct:								
	1. Technology base		259,757			241,598	18,159	
	Reimbursable program		5,000			5,000		
10 0001	Total		264,757			246,598	18,159	
Financing:								
Offsetting collections from:								
11.0001	Federal funds		-3,400			-3,400		
13.0001	Trust funds		-1,600			-1,600		
21.4001	Unobligated balance available, start of year						-18,159	
24.4001	Unobligated balance available, end of year					18,159		
40.0001	Budget authority (appropriation)		259,757			259,757		

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est	
Program by activities:								
Direct:								
	1. Technology base			326,600			306,992	
	Reimbursable program			9,000			9,000	
10 0001	Total			335,600			315,992	
Financing:								
Offsetting collections from:								
11 0001	Federal funds			-5,000			-5,000	
13 0001	Trust funds			-4,000			-4,000	
24 4001	Unobligated balance available, end of year						19,608	
40 0001	Budget authority (appropriation)			326,600			326,600	

417

Defense Nuclear Agency
RDT&E Performer Distribution
(\$ in Thousands)

(THIS CHART IS UNCLASSIFIED)

Appropriation: Research, Development, Test and Evaluation, Defense Agencies

	<u>FY 1981</u>	<u>Total Obligational Authority</u>		<u>FY 1984</u>
		<u>FY 1982</u>	<u>FY 1983</u>	
1. For operation of installations of the reporting DOD component gov't operated	10896	12872	13366	14580
2. For operation of installations of the reporting DOD component contractor operated	-0-	-0-	-0-	-0-
3. For contracts directly in support of work actually performed at installations of the reporting DoD component	-0-	-0-	-0-	-0-
4. For work assigned to DoD activities	44183	47772	40662	39400
5. For work assigned to activities of other Gov't agencies	16380	35680	63856	69381
6. For work performed by industrial contractors ("profit" organizations)	119844	154578	199129	227970
7. For work performed by educational institutions	3366	4258	5616	3381
a. <u>Designated Federal Contract Research Centers</u>	(-0-)	(-0-)	(-0-)	(-0-)
b. <u>Other Institutions</u>	(3366)	(4258)	(5616)	(3381)
8. For work performed by other "nonprofit" organizations	5102	4597	3971	2835
a. <u>Designated Federal Contract Research Centers</u>	(350)	(500)	(700)	(675)
b. <u>Other Institutions</u>	(4752)	(4097)	(3271)	(2160)
TOTAL RDT&E APPROPRIATION	199771	259757	326600	357547

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE NUCLEAR AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
INSTALLATION ANALYSIS - IN-HOUSE

(THIS NARRATIVE IS UNCLASSIFIED)

Narrative

The Defense Nuclear Agency (DNA) will operate three installations within Program Element 6.27.15.H, "Defense Nuclear Agency". This Program Element includes: (1) the combined Department of Defense (DoD) program for research and development in the effects of nuclear weapons which is developed through joint efforts of the Military Services and DNA to provide DoD with nuclear weapons effects information using all research and development means short of actual nuclear weapons detonation and certain large-scale field simulation tests; (2) the DoD portion of the joint Department of Energy (DOE)/DoD Nuclear Weapons Testing Programs and supports the execution of underground nuclear test events, the execution of nuclear weapons effects simulation test events using high explosives, the operation of nuclear weapons effects simulation facilities, and simulation of nuclear weapons effects using natural disturbances; (3) the development of a comprehensive evaluation and technology capability to provide solutions to improve the survivability and security of our present and expected theater nuclear weapons and forces; and (4) in FY 1983, the development of an Operational Test Site to permit testing and evaluation of security measures, including policy, criteria, and equipment in a total realistic environment.

Resources requested for the Armed Forces Radiobiology Research Institute include those required for administration, logistics support and conduct of research.

Resources requested for DNA Field Command Test represent in-house DNA efforts required for program management below Headquarters DNA level to include operation of facilities located at Albuquerque, New Mexico and Camp Mercury, Nevada.

Resources requested for DoD Operational Test Site include the requirements for administrative support located at Fort McClellan, Alabama.

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE NUCLEAR AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
INSTALLATION ANALYSIS - IN-HOUSE

(THIS CHART IS UNCLASSIFIED)

TOA (\$ in Thousands)									PERSONNEL (Man-Years)								
									Civil Service		Contractor		Mil. Pers.				
									Paid From DNA	Paid From Other	Paid From	Paid From	Paid From	In RDT&E Work	Other	Total	
									RDT&E	RDT&E	Other	RDT&E	Other				
Installation & Location	FY	Commands	Other DNA	Other DoD	All Funds	Sub-total	Mil. RDT&E	Pers. Other	Total	RDT&E	RDT&E	Other	RDT&E	Other	Work	Other	Total
Armed Forces	1981	8525		187	41	8753	2544		11297	118					84		202
Radiobiology	1982	9925		500	150	10575	3080		13655	131					91		222
Research Inst.	1983	10025		590	160	10775	3094		13869	137					92		229
Bethesda, MD	1984	10825		620	180	11625	3094		14719	137					92		229
Field Command	1981	2371		850	3222	6443	3315		9758	39					105		144
Test & Logistic	1982	2947		1400	2200	6547	3859		10406	45					114		159
Directorate	1983	3191		1330	4420	8941	4303		13244	47					130		177
Albuquerque, NM	1984	3605		1400	4200	9205	4303		13508	47					130		177
DoD Operational	1981																
Test Site	1982																
Ft. McClellan,AL	1983	150				150			150	1							1
	1984	150				150			150	1							1
TOTALS	1981	10896		1037	3263	15196	5859		21055	157					189		346
	1982	12872		1900	2350	17122	6839		24061	176					205		381
	1983	13366		1920	4580	19866	7397		27263	185					222		407
	1984	14580		2020	4380	20980	7397		28377	185					222		407

DEFENSE NUCLEAR AGENCY

FEDERAL CONTRACT RESEARCH CENTERS

(THIS PAGE IS UNCLASSIFIED)

Specialized technical support provided by Federal Contract Research Centers is used by the Defense Nuclear Agency (DNA) to supplement that which is available within the Department of Defense and from other sources. These Research Centers have been established by the Department of Defense (DoD) to provide expert technical and scientific services consistent with the goals and objectives of the DoD agencies utilizing them. Federal Contract Research Centers (FCRCs) are staffed with professionals who possess technical skills which make them uniquely qualified to participate in the specialized research and evaluation of the nuclear weapons effects program.

The alternative to FCRCs would be the utilization of other private contractors. This could result in a duplication of FCRC effort at an additional cost of both time and funds. The cost of DNA staff to contract and supervise technical effort by a private contractor would exceed that of an FCRC performing this work. The proposed FY 1983 FCRC program will provide for technical direction, principal technical interface with private contractors and timely implementation of programs.

The following summary identifies DNA's estimated Federal Contract Research Center requirements utilizing Research, Development, Test and Evaluation appropriation resources.

FEDERAL CONTRACT RESEARCH CENTERS

Summary by Appropriation/Project
(\$ in Thousands)

(THIS SUMMARY IS UNCLASSIFIED)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
<u>AEROSPACE CORPORATION</u>				
Research, Development, Test and Evaluation (RDT&E), Defense Agencies				
6.27.15.H Defense Nuclear Agency (DNA)				
Total RDT&E, Defense Agencies	350	500	700	675
Total Aerospace Corporation	350	500	700	675

Remarks:

Aerospace Corporation provides technical assistance to the Defense Nuclear Agency in the development of erosion resistant nosetips, radiation shields, advanced composite heat shields and substructures for reentry vehicles that must be hardened to withstand single and multiple nuclear burst environments and directed energy attack. It provides similar assistance in the development of hardened impact fuses, booster components and in materials technology for strategic aircraft. Threats include nuclear radiation and airborne debris fields. The technology base is required by the Air Force to support full-scale system development activities. It also provides for structural calculations of the hardness of missile silo structures and components. Aerospace personnel will evaluate energy deposition models and provide technical assistance in evaluating missile and reentry vehicle aerodynamics following a combined nuclear and directed energy attack. Finally,

FEDERAL CONTRACT RESEARCH CENTERS

Summary by Appropriation/Project (Continued)
(\$ in Thousands)

(THIS SUMMARY IS UNCLASSIFIED)

it provides laboratory trouble shooting and special assessment support on assigned topics of interest to the strategic aerospace and structures community. System designs to be used in M-X and Trident may be required to undergo multiple intercepts and to maintain standards of accuracy required to achieve prescribed damage expectancy levels. The FY 1983 funding levels provide continuing support for missile and reentry vehicle hardness concept verification.

TOTAL PROGRAM SUMMARY BY APPROPRIATIONS

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
Research, Development, Test and Evaluation (RDT&E), Defense Agencies	350	500	700	675
Total Federal Contract Research Centers (In-House Efforts) Funded in FY Subcontract Effort excluded from this amount	0	0	0	0
TOTAL FEDERAL CONTRACT RESEARCH CENTERS	350	500	700	675

DEFENSE NUCLEAR AGENCY
DEPARTMENT OF DEFENSE, MILITARY

(U) MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES
FUNDED BY RDT&E

(U) PART 1. UTILIZATION OF SECTION 2353, TITLE 10 AUTHORITY:

(U) NONE

(U) PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED/GOVERNMENT-OPERATED INSTALLATIONS

<u>Facility/Equipment</u>	<u>RDT&E Project Number</u>	<u>Contractor/Location</u>	(\$ in Thousands)			
			<u>Total Obligational Authority</u>			
			<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>
<u>SECTION I</u>						
a. (U) Satellite X-ray Test Facility (SXTF)	G37L	Arnold Engineering Development Center (AEDC), Tullahoma, Tennessee	8,100	760		
b. (U) DoD Operational Test Site	B99QAXRE	TBD/Ft. McClellan, AL	200	1,000	3,660	5,010

SECTION II

(U) Projects Planned or
Projected - NONE

(U) MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES
FUNDED BY RDT&E (Continued)

a. (U) Satellite X-ray Test Facility

(U) This Satellite X-ray Test Facility was for the purpose of testing satellites in a simulated nuclear and space environment to determine the effects of weapons relatable X-rays on full-scale satellites in their operational configuration. On August 1981, by memorandum, the Under Secretary of Defense for Research and Engineering terminated the program before any contracts were let for the acquisition of the facility. The FY 1982 funds shown are for concluding research and development that had been initiated in FY 1981 before the cancellation decision was made.

b. (U) DoD Operational Test Site

The DoD Operational Test Site will fill an existing void in doctrinal development and test and evaluation of physical security systems with emphasis on the [] The site will provide capabilities to support Service [] security doctrinal development projects; force development/operational testing of doctrine, policy, criteria, hardware, facilities, arms equipment, and human factors in a total real-world environment; and support of [] contingency planning of the operational commands. The test site will be planned, designed, and constructed under the supervision of the Defense Nuclear Agency in close coordination with the U.S. Army Military Police at Ft. McClellan, Alabama and will be initially operated by DNA on behalf of DNA, the Services, and the operational commands. The initial configuration (base line) of the Test Site will be a type [] with appropriate facilities

and designed with the capability to reconfigure [] to permit flexibility in testing. Instrumentation will be incorporated in the test site for data collection and analysis.

(U) MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES
FUNDED BY RDT&E

3. UTILIZATION OF RDT&E APPROPRIATION FOR MINOR CONSTRUCTION:

(U) SUMMARY OF MINOR CONSTRUCTION FUNDED BY RDT&E DEFENSE AGENCIES

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>
(U) TOTAL, PART 3	84.2	394.0	447.0	391.0
<u>TOTAL</u> , Major Improvements to and Construction of Government-Owned Facilities Funded by RDT&E	8,384.2	2,154.0	4,107.0	5,401.0

RDT&E INSTALLATION PROJECT FACT SHEET

(THIS EXHIBIT IS UNCLASSIFIED)

I. Facility/Equipment: Satellite X-ray Test Facility

II. R&D Program Elements: 6.27.15.H

III. R&D Project Number: T99Q and G37L

IV. Location: Site selection was narrowed to either National Aeronautics and Space Administration (NASA), Houston, Texas, or Arnold Engineering Development Center (AEDC), Tullahoma, Tennessee; selection would have been made in 1981.

V. Summary of R&D Funds: (\$ in thousands)

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>FY 1985</u>	<u>FY 1986</u>	<u>FY 1987</u>	<u>TOTAL</u>
6.27.15.H (G37L)	8100	760						27460
6.27.15.H (T99Q)								10500
R&D Total	8100	760						37960

VI. Summary of Other Funds: None

VII. Relationship to R&D Program:

This installation project would have provided a major laboratory simulation capability to determine the system generated electromagnetic pulse (SGEMP) effects induced in satellite systems by X-rays from nuclear weapons.

VIII. Rationale for funding in R&D rather than MILCON or O&M appropriation:

The developmental nature of the photon (X-ray) source and the environmental test chamber dictated that these items be funded in the R&D appropriation.

RD&E INSTALLATION PROJECT FACT SHEET

(THIS EXHIBIT IS UNCLASSIFIED)

I. Facility/Equipment: DoD Operational Test Site

II. R&D Program Elements: 6.27.15.H

III. R&D Project Number: B99QAXRE

IV. Location: Ft. McClellan, Alabama

V. Summary of R&D Funds: (\$ in thousands)

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>FY 1985</u>	<u>FY 1986</u>	<u>FY 1987</u>	<u>TOTAL</u>
6.27.15.H (B99QAXRE)	200	1,000	3,660	5,010	4,700	2,650	2,950	20,170
R&D Total	200	1,000	3,660	5,010	4,700	2,650	2,950	20,170

VI. Summary of Other Funds: None

VII. Relationship to R&D Program:

The DoD Operational Test Site will fill an existing void in doctrinal test and evaluation of physical security systems with emphasis on the protection of nuclear weapons.

VIII. Rationale for funding in R&D rather than MILCON or O&M appropriation:

The DoD Operational Test Site is being designed to be a reconfigurable prototype facility integral to physical security research efforts. Accordingly, it is to be funded from the RD&E appropriation.

DEFENSE NUCLEAR AGENCY
Minor Construction Projects
Funded by RDT&E

(THIS EXHIBIT IS UNCLASSIFIED)

Activity	Building	Brief Description of Work	(\$ in Thousands)			
			Cost			
			FY 1981	FY 1982	FY 1983	FY 1984
Armed Forces Radiobiology Research Institute (AFRRI) Bethesda, Maryland	Bldg #42 Medical Center Bethesda, MD	Installation of pull box and Conduit for telephone Cable	2.5			
		Alterations to entrance, miscellaneous interior alterations, and drain- age structure	44.7			
		Alterations to Laboratories		170.0	170.0	235.0
		Install Air Conditioning, Equipment Rooms			40.0	25.0
		Repair Roof Flashing		10.0	10.0	5.0
		Upgrade Fire Protection, Equipment Rooms		10.0	10.0	10.0
		Upgrade Electrical Service		30.0	50.0	
		Upgrade Fume Hoods		10.0	10.0	
		Improve Air Exchange/Supply		5.0	10.0	
		Replace Warm Waste Pumps		10.0		
		Install Emergency Shower & Eye Wash Stations		10.0		
		Replace Water Pipe, Selected Areas		20.0	20.0	10.0
		Ground Fault Protection, Selected Areas		18.0	10.0	10.0
		Alterations to Accommodate Handicapped		7.0		5.0
		Upgrade Hot Chemistry Lab			15.0	

Minor Construction Projects
Funded by RDT&E (Cont'd)

Activity	Building	Brief Description of Work	(\$ in Thousands)			
			FY 1981	FY 1982	FY 1983	FY 1984
		Provide Acid Storage Area			10.0	10.0
		Modify Electrical Equip- ment (Grounding)		15.0	15.0	10.0
		Upgrade Laboratory Ventilation		10.0	10.0	10.0
		Extend Warm Waste Lines		10.0	10.0	10.0
		Upgrade Environmental Controls		10.0	10.0	10.0
		Cross Connect Air Conditioning		5.0		
Field Command Defense Nuclear Agency (PCDNA) Kirtland AFB, New Mexico	Bldg #210 Test Construction Division Nevada Test Site Mercury, Nevada	Resurface roadway around building and loading docks Space		44.0		
		Resurfacing of the Motor Pool Area			47.0	
	Bldg #211 Test Construction Div, Nevada Test Site Mercury, Nevada	Construct shelter, cable yard	37.0			
	Bldg #600, #211, #210, Test Con- struction Division, Nevada Test Site, Mercury, Nevada	Paint Offices and Buildings				41.0
		Total Minor Construction Funded in RDT&E	84.2	394.0	447.0	391.0

430

432

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE NUCLEAR AGENCY
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

DETAIL BY BUDGET ACTIVITY
(\$ in thousands)

(THIS CHART IS UNCLASSIFIED)

			FY 1981 <u>Actual</u>	FY 1982 <u>Estimate</u>	FY 1983 <u>Estimate</u>	FY 1984 <u>Estimate</u>	Descriptive Summary <u>Page No.</u>
1. <u>TECHNOLOGY BASE</u>							
<u>Element Code</u>	<u>Project No.</u>	<u>Title</u>					
6.2	<u>EXPLORATORY DEVELOPMENT,</u> <u>DEFENSE AGENCIES</u>						
6.27.15.H		<u>DEFENSE NUCLEAR AGENCY (DNA)</u>	<u>199771</u>	<u>259757</u>	<u>326600</u>	<u>357547</u>	
		TOTAL, EXPLORATORY DEVELOP- MENT, DEFENSE AGENCIES	199771	259757	326600	357547	432

DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Program Element: #6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ in thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
6.27.15.H	<u>DEFENSE NUCLEAR AGENCY (DNA)</u>	<u>199771</u>	<u>259757</u>	<u>326600</u>	<u>357547</u>	Continuing	N/A
N	Aerospace Systems Vulnerability and Hardening	8718	11200	11500	11900	Continuing	N/A
O	Command, Control and Communications (C ³)	4962	7900	9200	9800	"	"
P	Effects/Vulnerability Assessment & Data Evaluation	12192	19057	20300	22347	"	"
S	High Altitude Phenomenology and Applications	6537	8400	11000	11100	"	"
T	Laboratory Radiation Simulator Development	14758	12200	19800	18400	"	"
U	Biomedical Effects Research	12484	15400	16300	17100	"	"
V	Tactical Systems Vulnerability and Hardening	25022	20800	21000	21200	"	"
W	Strategic Nuclear Implications and Assessments	4011	4500	5300	5100	"	"
X	Nuclear Effects on Electronics	13458	20300	23300	29200	"	"
Y	Strategic Structures Vulnerability and Hardening	10598	21300	21300	21100	"	"
G	Effects Simulation Using Radiation Simulators	19391	19500	31700	36900	"	"
H	Effects Simulation Using High Explosives	10056	6300	9900	7200	"	"
I	Effects Simulation Using Natural Disturbances	7522	10400	11800	14000	"	"
J	Underground Nuclear Tests	30592	65800	97500	114600	"	"
A	Theater Nuclear Forces Survivability Security and Safety (TNFS ²)	14139	8900	7100	6000	"	"
B	Physical Security	5331	7800	9600	11600	"	"

(U) Program Element: #6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The program element which supports research, development, test and evaluation for the Defense Nuclear Agency will provide:

1. (U) Planning and execution of theoretical and experimental research and testing in nuclear weapons effects;
2. (U) Development of analytical and experimental methodologies and techniques for evaluating phenomenology and system responses in various nuclear burst environments such as high altitude, near surface, surface, underwater, and underground; and development and construction of nuclear radiation sources for laboratory and large-scale field simulation techniques;
3. (U) Correlation of nuclear weapons effects information combined with hardening techniques which affect reliability and survivability of tactical and strategic weapons systems; command, control and communications systems; and satellite systems;
4. (U) Laboratory research to define the physiological and pathological response in humans to blast, thermal and ionizing radiation from nuclear weapons;
5. (U) Preparation and execution of underground nuclear weapons effects tests; near surface high explosive and thermal testing to simulate certain aspects of nuclear phenomenology; design, construction, operation, and maintenance of nuclear weapons effects laboratory simulation facilities; conduct of field measurement exercises to evaluate natural and artificially induced disturbances which produce effects similar to those deriving from high altitude nuclear detonations; and design and development of test instrumentation and techniques;
6. (U) Increase the effectiveness, increase protection and improve dispersal capabilities of theater and strategic nuclear forces by developing concepts for technological, operational and procedural improvements;
7. (U) Evaluate and test concepts to determine effective and efficient methods and equipment for improvement in the nuclear weapons security program; and
8. (U) Develop radiation exposure histories for individuals involved in the Nuclear Test Program.

(U) Program Element: #6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

C. (U) BASIS FOR FY 1983 RDT&E REQUEST:

1. (U) Planned Efforts: The nuclear weapons effects needs of systems developers continue to rise primarily due to an increase in weapon system sophistication in the U.S. and the U.S.S.R. This driving force results in increased emphasis of testing and evaluating nuclear weapons effects on strategic and tactical nuclear forces and their ability to survive an enemy attack and endure in the post attack period. A primary goal will be upgrade of nuclear weapons effects phenomenology in areas enhanced due to the increased sophistication of weapons systems. Efforts will be directed toward programs which contribute to the effectiveness and survivability of land based intercontinental ballistic missile and associated advanced ballistic missile systems; the TRIDENT II submarine launched ballistic missile; the air launched cruise missile; advanced strategic aircraft; satellites; surface ships and submarines; the endurance of command, control and communications; and man. Progress will be made in options for nuclear weapon employment; enduring nuclear weapon planning capabilities; nuclear weapons effects against specific targets; and secondary weapons effects. Soviet strategy, doctrine and future technological developments will be assessed for potential impact on U.S. and Allied doctrine, weapons allocation and requirements for nuclear weapons effects information with particular emphasis on protracted war scenarios. The HURON LANDING and DIAMOND ACE underground nuclear tests will be executed. Design and construction of the DIAMOND BEECH and MIDAS MYTH underground nuclear test beds will begin. In addition, major upgrades to facilities and instrumentation will continue at the Nevada Test Site. Construction of a DoD Operational Test Site at Fort McClellan, Alabama will begin. Research efforts will emphasize unit performance degradation, injury, and protection against the deleterious effects of ionizing radiation.

2. (U) Cancelled Effort: The research, development, test and evaluation activities in support of the Satellite X-ray Test Facility (SXTF), first begun in FY 1977, have been terminated at the direction of the Under Secretary of Defense for Research and Engineering (USDRE).

3. (U) Progress to date:

a. (U) Strategic Applications: Significant improvements in both theoretical and experimental techniques were accomplished and the results applied to a variety of programs including M-X advanced basing, ballistic missile defense system, B-52, and the submarine launched ballistic missile/fleet ballistic submarine (nuclear). Nuclear effects on electronics have

(U) Program Element: #6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

been documented in the final inflight specifications for the M-X missile. An electromagnetic pulse hardening program was defined for the Low Altitude Defense System. Underwater phenomenology and submerged structures technology were extended to develop a basic understanding of the vulnerability and survivability of submarines. Nuclear weapons employment against Soviet nuclear forces, power projection forces and the political and military command structures has been evaluated. Technology base developments in understanding of free-field phenomenology have been integrated with test results to increase the understanding of system structural response to new complex attack scenarios.

b. (U) Enduring Command, Control and Communications (C³): Primary emphasis has been on developing a single assessment methodology to be used for assessing C³ systems. Progress has been made in producing protection standards, specifications, handbooks and guidelines for use by engineers in the design of equipment, facility and system protection.

c. Theater Nuclear Warfare: Research has been directed towards evaluation of alternative nuclear weapon systems and force mixes. Investigations have been conducted to determine optional nuclear weapon employment against Soviet/Warsaw Pact forces, airfields, and logistics. A net assessment has been conducted of U.S. and Soviet theater nuclear force capabilities in the European and Pacific theaters. Automated planning aids for employing developed and tested in field exercises. To enhance the survivability of theater nuclear forces and their command structure, DNA has designed and tested in situ nuclear weapon storage techniques for aircraft hangarages; dispersed headquarters command and control techniques; and off-site ground launched cruise missile security measures.

d. Testing: The MINERS IRON underground nuclear weapons effects test was conducted which supported the design and development of the M-X missile. Data were obtained relating structural and thermomechanical responses of possible missile components and materials to threat. Design and construction of the HURON LANDING and DIAMOND ACE underground nuclear tests was begun. In addition, MILL RACE, the first major high explosive test in the MISTY CASTLE series took place. This test supported Army tactical battlefield requirement by providing a simulated blast and thermal environment from a surface burst of a 1 kiloton nuclear weapon. Three major simulation facilities have continued operation - ARES, CASINO, and AURORA. Electromagnetic pulse (EMP) testing in support of the A-7 aircraft assessment is complete and testing of the F-14 is nearing completion.

(U) Program Element: #6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

e. (U) Biomedical Effects: Data obtained from exposure of experimental animals to simulated weapons spectra have been extrapolated to allow prediction of personnel exposure responses. The development was made of a more efficient cell separation, cultural, and storage techniques for bone marrow cells and in the enhancement of post irradiation blood cell production. The Nuclear Test Personnel Review has identified over 85 per cent of the estimated 224,000 participants in the DoD atmospheric tests and recovered dose information on over 34 percent of these individuals. Reconstruction of possible radiation exposures to the U.S. forces in the 1945-1946 occupation of Hiroshima and Nagasaki has been completed.

f. Nuclear Weapons Effects Assessment/Dissemination: Evaluation of the sensitivity of a -- system to two nuclear weapons effects -- source region EMP and multiple burst airblast -- had a major impact on the definition of system parameters. Nuclear planning capabilities of Allied Command Europe and the U.S. European Command were improved by exploitation of data processing and improved collateral effects evaluations. As the DoD focal point for information and data on nuclear weapons effects and phenomenology, DASIAC, the DoD Nuclear Information and Analysis Center continued efforts in acquiring, interpreting and compiling technical information in response to the needs of the scientific community.

D. (U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

1. (U) Increased FY 1983 funding will continue emphasis on revitalizing DNA's nuclear weapons effects technology base and testing activities. In the FY 1983 program DNA will place greater emphasis on:

a. (U) Initiation of an Electromagnetic Pulse Protection Technology Program for application to Strategic Aircraft which includes development of standards and specifications, protection alternatives and hardness validation methodologies.

b. (U) Theoretical results confirmed by extensive field experiments using barium releases and natural disturbances have demonstrated that, given a proper description of the environment, we can accurately predict propagation effects and develop mitigation techniques for satellite communications systems. Emphasis has been shifted to address the major environmental uncertainties which remain. This will be accomplished through theoretical efforts and laboratory and field experiments to verify theoretical results. Additional emphasis is also being placed on the long wavelength infrared environment for ballistic missile space defense applications.

(U) Program Element: #6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

c. (U) Research on the requirements for flexible, survivable, and enduring strategic nuclear forces based on changes in the National strategic policy and Policy Guidance for Employment of Nuclear Weapons.

d. (U) Research activities involving the command and control capabilities of theater nuclear forces and weapons will be greatly enhanced. Numerous Headquarters configurations which are more survivable against nuclear attack will be designed and field tested to evaluate their effectiveness. Tests will be conducted of communication equipment and networks used to control the release of nuclear weapons. The ability of nuclear force commanders to employ nuclear weapons will be enhanced thru the evaluation of diverse automated battle management techniques which DNA will develop and test. Another area for increased investigation will be the Pacific Command's needs for enhanced nuclear forces; based on a detailed assessment of the command's forces vis-a-vis the Soviet Union's for a broad spectrum of situations, the DNA research will prescribe the nuclear forces and weapons needed by the Pacific area commanders.

e. (U) Conversion of existing, proven radiation source Research and Development capabilities into testing facility form for nuclear weapons effects simulation, research, and testing.

f. (U) Multiple underground test events for research of system generated electromagnetic pulse, cratering physics, and test techniques for evaluating the X-ray response of military systems and major refurbishment and modification of facilities and instrumentation at the Nevada Test Site. Above ground tests for blast and shock support to all Services and for expansion of the technology base on high latitude nuclear burst effects on communications.

g. (U) Emphasis has been placed on examination of nuclear weapons effects on alternate basing options for the M-X missile and associated protective systems.

h. (U) Building of a Department of Defense Operational Test Site to exercise and evaluate physical security systems.

i. (U) Increased emphasis on electronics hardening technology. In particular, we will initiate a substantial effort to support hardening Very High Speed Integrated Circuit (VHSIC) parts to the effects of ionizing radiation.

(U) Program Element: #6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

2. (U) Specific and detailed descriptive summaries, by project, follow the summary of this program element.

E. (U) OTHER APPROPRIATIONS:

	(\$ in Thousands)			
<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	
	500	200	8500	

(U) Military Construction

- (a) (U) FY 1982 - Wall and roof insulation for the Armed Forces Radiobiology Research Institute (AFRRI)
- (b) (U) FY 1983 - Construct a storage building for the AURORA facility.
- (c) (U) FY 1984 - Upgrade mechanical and electrical system at the AFRRI.

DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E Descriptive Summary

(U) Project #: N

(U) Title: Aerospace System Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) This project provides the nuclear and directed energy weapons effects information and simulation test techniques needed for the design, development, evaluation, and testing of strategic and tactical missiles, aircraft, and tactical ground systems that may be exposed, while in operational use to nuclear and directed energy environments. The objectives of the program are to supply missile, aircraft, and tactical equipment designers/developers and operational planners with nuclear weapons effects information and simulation test techniques which:

a. (U) Predict, with confidence, the blast, thermal, X-ray, dust and hydrometeor environments resulting from the detonation of strategic and tactical nuclear weapons.

b. (U) Permit the design, test, and evaluation of the effects of nuclear and directed energy environments on personnel protection and weight critical missile, aircraft, and tactical ground systems components and structures.

2. (U) The program is accomplished by developing and evaluating new, hardened materials, concepts and structural designs for operational and advanced missile, tactical ground systems and aircraft; by characterizing, modeling, and simulating the directed energy, nuclear and hydrometeor environments of interest; by evaluating the degradation of missiles (including their accuracy), aircraft and tactical ground systems operating in these environments in a protracted nuclear war and by correlating the data obtained from laboratory simulations and high explosive tests with underground nuclear tests to provide hardness verification. Success is measured by the extent to which the products of this research are used by system designers and developers, and by operational planners for systems employment.

ct #: N

(U) Title: Aerospace Systems Vulnerability and Hardening

Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

RELATED ACTIVITIES: The results of this work are applied directly to such strategic systems as the [] and such advanced systems and components as the []. This provides essential inputs for the programming of strategic nuclear engagement scenarios, special interpretations of intelligence data based on nuclear weapons effects applications, and national policy formulation for use in defining the strategic situation talks (START).

WORK PERFORMED BY: Department of Defense (DoD) agencies, private sector contractors, Federal Contract Research Centers, and other organizations.

(U) Principal DoD agencies include the Air Force Ballistic Missile Office; Air Force Materials Laboratory; Air Force Research Laboratory; Air Force Rocket Propulsion Laboratory; Air Force Holloman Test Center; Air Force Arnold Engineering Development Center; Army Nuclear and Chemical Agency; Army Ballistic Research Laboratories; Army Ballistic Missile Defense Systems Research and Development Command; Army Harry Diamond Laboratories; Naval Surface Weapons Center; and Naval Weapons Evaluation Facility.

(U) Contractors, Federal Contract Research Centers (FCRC's) and nonprofit organizations, include Acurex Corp.; the Boeing Aircraft Co.; Effects Technology, Inc.; General Electric Co.; Haveg Industries; Kaman Science Corp.; Lockheed Martin Space Co.; Science Applications, Inc.; TRW, Inc.; Calspan Corp.; California Research and Technology, Inc.; Systems, Data Research, Inc.; Particle Measuring Systems, Inc.; Williams International; General Research Corp.; Prototype Development, Inc.; Physics International Co.; McDonnell Douglas Astronautics Co.; APTEK, Inc.; Aerospace Corp. (FCRC), and SRI International (nonprofit).

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

FY 1981 AND PRIOR ACCOMPLISHMENTS: Advances over the past ten years have resulted in the quantitative definition

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(U) Project #: N

(U) Title: Aerospace Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

of nuclear environments; the development of simulation test techniques/facilities; the establishment of damage prediction methods; the development of hardened material and design concepts for application to strategic and tactical missiles and aircraft systems; and the establishment of aboveground testing and analysis techniques to augment underground tests for verifying the nuclear hardness of strategic missiles. These results have been applied to meet the required nuclear hardness and accuracy goals for United States intercontinental ballistic missiles and submarine launched ballistic missiles; to improve the survivability of strategic aircraft; and to assess Soviet aerospace systems capabilities. Recent accomplishments include: Advanced Missile Survivability (Flvout); Nuclear Hardness Evaluation Procedures to verify survivability by analysis and aboveground experiments; Aircraft Survivability Assessment to gust loading; Development of an aircraft canopy for nuclear thermal protection; Demonstrated Reentry Vehicle X-ray Hardening and Initiation of a Directed Energy Effects program to make hardened missile systems survivable to both X-ray and laser effects.

2. FY 1982 PROGRAM: The M-X support program will demonstrate components for missile launch under nuclear attack. will concentrate on further development of the hyperballistic range to launch reentry vehicle models at the Arnold Engineering Development Center and on cruise missile engine tests in blast and environments. The reentry vehicle antenna and missile booster components program will evaluate new hardened materials and designs. Specialized materials for cockpit crew protection against multiple bursts will be tested in the aircraft survivability program. Nuclear atmospheric test data on aircraft will be reviewed and correlated with aircraft dynamic response analytical models. The Directed Energy Effects program will obtain the response of representative missile and reentry vehicle protective materials. The MILL RACE drone flyby and the optical attenuation experiment results will be correlated with analytical models.

3. FY 1983 PLANNED PROGRAM: Technological Nuclear Hardening and Survivability requirements for aerospace systems will continue in FY 1983.

(U) Project #: N

(U) Title: Aerospace Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

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(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

New initiatives requiring continued development are: M-X penetration aids, small missile and canister, tactical ground forces modernization; improved advanced composites for aircraft, and hardened fuze testing. Finally, as in the past, nuclear weapons effects assessment and applications to operational planning and intelligence interpretations will continue on an ad hoc basis. The compatibility of nuclear protection

4. (U) FY 1984 PLANNED PROGRAM: Technology requirements for tactical ground systems, missile systems, reentry vehicles, and flight systems will continue in FY 1984. HURON LANDING experimental results involving M-X subsystems, anti-ballistic missiles, and advanced reentry vehicles will be correlated with analytical models. Experiments will be conducted to simulate the generation of nuclear dust clouds verify nuclear cloud characteristic models. Blast and thermal effects of advanced flight systems involving stealth design and material concepts will be investigated. Flight system vulnerability prediction codes will be correlated with high explosive and aboveground nuclear test data to improve prediction confidence. Directed energy weapon effects on missile and aircraft systems will continue to be evaluated; prediction models will be developed and verification testing will be conducted.

5. (U) PROGRAM TO COMPLETION: This is a continuing program. The assessment and application of nuclear weapons effects information will be adjusted to meet current and new development needs as they occur.

6. (U) MILESTONES:

FY 1982 a. Continue directed energy effects research to establish whether or not materials developed to protect against nuclear threats

(U) Project #: N

(U) Title: Aerospace Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

b. (U) Define the environment and nuclear induced structural loading for the anti-ballistic missile interceptor and radar.

c. (U) Develop large-scale validation test methods for M-X missile components and reentry vehicle antennas and field correlating experiments in the HURON LANDING underground test.

d. (U) Validate aircraft vulnerability prediction codes with drone flyby data and nuclear test data.

e. (U) Complete blast response sled testing of cruise missile class structure and propulsion system.

f. (U) Initiate new program for hardness requirements of secure land and airbased small missiles.

g. (U) Initiate new program for enduring survivability and reconstitution of tactical ground forces.

FY 1983 a. (U) Correlate atmospheric nuclear test data with aircraft weapons effects vulnerability codes.

b. (U) Conduct blast and thermal survivability tests using advanced aircraft designs and composite materials.

c. (U) Coordinate and conduct high energy laser effects testing for the services to support research to quantize laser interactions with materials and structures.

d. (U) Conduct MIDAS MYTH underground nuclear effects testing of advanced reentry vehicle and missile materials.

(U) Project #: N

(U) Title: Aerospace Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

			(\$ in Thousands)		COST TO
	FY 1981	FY 1982	FY 1983	FY 1984	COMPLETION

7. (U) RESOURCES: Aerospace Systems Vulnerability and Hardening

8,718	11,200	11,500	11,900	Continuing
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a. BASIS FOR FY 1983 REQUEST: The FY 1983 request will support: (1) The continuation of the advanced missile survivability program during the full scale engineering design phase, (2) the continuation of active, erosion resistant nosetip and directed energy research, (3) the development and application of nuclear effects simulators, (4) the correlation of aircraft and cruise missile response to nuclear loads, (5) the continued adaptation of nuclear weapons effects information and related hardware/software to current, high priority problems in need of solution, and (6) expansion of the data base for tactical ground system effects in a protracted nuclear war.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM 1982: No significant increase occurs for this project, but programmatic progress in directed energy effects research and nuclear weapons effects simulators have resulted in funding level adjustments. New initiatives into the phenomenology of nuclear weapons effects on tactical mobile ground systems and the required hardening to attenuate those effects have also contributed to funding adjustments.

DEFENSE NUCLEAR AGENCY
FY 1983 RDT&E DESCRIPTIVE SUMMARY
(THIS SUMMARY IS UNCLASSIFIED)

Project #: 0

Title: Command, Control, and Communications (C3)

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

F. DETAILED BACKGROUND AND DESCRIPTION:

1. The objective of this project is to support and assist the Services, Commanders-in-Chief, and agencies of the Department of Defense in the implementation of nuclear weapon effects protection for all C³ assets, by development of protection technology and procedures and tests for validation and maintenance of protection.

2. The objective is accomplished by (1) assimilating the nuclear survivability assessment methods and technology, evaluating their effectiveness and discarding those that do not contribute to survivability enhancement; (2) developing new methods and technology and exercising them on representative C³ systems; (3) incorporating results into a data base supporting survivability enhancement standards and practices; and, (4) maintaining the data base for the use of Department of Defense activities. The technology, procedures, practices, and standards will be shared, as appropriate, with the North Atlantic Treaty Organization (NATO) and other United States Allies. The results of this program provide a direct input into the design of future C³ systems and facilities and will provide guidelines and practices for enhancing the survivability of existing assets.

G. RELATED ACTIVITIES: This project provides support to the Department of Defense, Defense Agencies, NATO and Service-funded activities in determining the effectiveness of tactical and strategic communications systems when stressed with environments produced by nuclear weapons detonations.

H. WORK PERFORMED BY: Department of Defense agencies, nonprofit organizations, and civilian contractors. Nonprofit organizations include SRI International, and the Georgia Institute of Technology's Engineering Experimentation Center. Civilian

Project #: 0

Title: Command, Control, and Communications (C³)

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

contractors include R&D Associates, Boeing Aerospace Corp., Mission Research Corp., Kaman Sciences (TEMPO), IRT Corp., Booz-Allen & Hamilton, Rockwell International, and Science Applications, Inc.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: The groundwork for this project was laid in past programs where techniques and test equipment were developed to perform nuclear weapons effects vulnerability assessments of continental United States and Pacific Command (PACOM) communications networks. Basic electromagnetic pulse (EMP) assessment technology and network end-to-end evaluation techniques were developed under these programs. Facility vulnerability data were obtained as well as information on the wide variation in configurations and installation practices that exist and which complicate the development of uniform protection criteria. An evaluation of the nuclear survivability of the communications supporting the release and employment of theater nuclear weapons was completed. A program to assist the North Atlantic Treaty Organization (NATO) in the development of a survivability program for their C³ systems was initiated focusing principally on protection technology for EMP. A program to develop EMP life cycle protection costs for communications facilities supporting the Worldwide Military Command and Control System was initiated.

2. FY 1982 PROGRAM: Efforts in FY 1982 will concentrate on two main areas; (1) development and evaluation of EMP protection validation assessment and test procedures (protocols) to be used for demonstration of the achievement of protection, and (2) the acquisition of data relating to the performance and cost of alternative protection concepts installed at C³ facilities. These major activities will provide data to support development of hardness assurance maintenance and surveillance programs necessary to maintain integrity of protection, will identify operational constraints which degrade protection or impact cost of maintenance, and provide opportunities for certification of protocols on protected facilities. Life cycle cost data will be collected at four PACOM facilities protected as part of the DNA project and additional facilities protected by PACOM. Protection and initial evaluations will be completed in FY 1982. Protection validation protocols, initiated last fiscal year, will be initially tested by applications to these facilities and requirements for improvement and refinements will be identified. Data will be collected on performance, maintainability, reliability, and completeness of protection measures as well as costs to maintain and refine protection as it degrades. These data will serve as valuable inputs to a protection handbook for new facilities to be initiated this year (as a forerunner to a Military Standard for EMP Protection), and the collective results of the project support

Project #: C

Title: Command, Control, and Communications (C³)

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

DNA's technical management of a National Communications System program to evaluate feasibility of electromagnetic pulse (EMP) protection of the Nation's common carrier telecommunications, an initiative undertaken to support the National Security Council/Presidential Directive-53 (NSC/PD-53). A program examining potential conflicts between existing military standards and EMP protection requirements will be completed and will identify issues that will need to be addressed by electronics community before an EMP protection military standard is developed. Data from Service agencies and government contractors are being collected and organized to provide a single reference point for information concerning threshold levels for upset and damage of communications piece parts and equipment.

3. FY 1983 PLANNED PROGRAM: Evaluation of the adequacy of assessment and testing methods will continue, through application to the Pacific Command (PACOM) protected facilities, and will be refined and modified as needed. Planning for final certification of the protocol will be initiated to ensure technical issues are addressed in threat level testing to be conducted as part of DNA's support to the NSC/PD-53 program. EMP Protection Handbook for C³ facilities will be completed for use for new construction, and initial frameworks for military standards will be developed. Initial evaluation of potential EMP vulnerabilities in national electric power distribution systems as they relate to enduring C³ will be produced. Data on effectiveness and cost of alternative methods for installing shielding in new and existing communications facilities will be collected and published. Examinations of the feasibility and practicality of simple EMP C³ test bed will continue with emphasis on testing requirements.

4. FY 1984 PLANNED PROGRAM: The program for FY 1984 will continue to emphasize development and certification of protection technology and verification methods for EMP protection of vital C³ facilities. Technology developed under this project will be used by Services and agencies to develop EMP protection strategies, cost estimates, and develop hardness assurance and surveillance operational and maintenance requirements necessary to maintain protection. This continuing evaluation of technology will be applied as required to existing facilities and equipment to gain information relating to adequacy and applicability, to assist operators in understanding vulnerabilities, and in the development of protection programs.

5. PROGRAM TO COMPLETION: This is a continuing program. The level of effort will be programmed to that necessary to obtain nuclear vulnerability data, to incorporate refined nuclear vulnerability tools, and to refine practices, procedures, and standards to maintain the survivability of C³ supporting the Nation's Armed Forces.

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Project #: 0

Title: Command, Control, and Communications (C³)

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

6. MILESTONES: Changes from the January 1981 submission are attributable to a maturing of the program based on data received since January 1981. Changed milestones more clearly define the program in follow-on years and reflect re-emphasis.

FY 1982 Initiate development of electromagnetic pulse (EMP) protection validation protocol. Complete in-residency support to the North Atlantic Treaty Organization (NATO) Survivability Section. Collect life cycle cost data on EMP protected facilities. Initiate development of EMP Protection Handbook.

FY 1983 Initiate military standard for EMP protection specifications. Evaluate efficiency and effectiveness of hardness assurance methods. Assist Services, Department of Defense agencies and others in applying EMP protection strategies. Acquire EMP protection data, life cycle cost data. Refine and test validation protocols.

FY 1984 Complete assessment of EMP vulnerabilities of national power grid facilities. Publish first version of EMP protection military standard. Assist Services, Department of Defense agencies and others in applying EMP protection strategies.

	<u>FY 1981</u>	<u>FY 1982</u>	(\$ in Thousands)		<u>COST TO COMPLETION</u>
			<u>FY 1983</u>	<u>FY 1984</u>	
7. <u>RESOURCES</u> : Command, Control, and Communications (C ³)	4,962	7,900	9,200	9,800	Continuing

a. BASIS FOR FY 1983 REQUEST: The FY 1983 request will provide funds for the further refinement and application of the C³ assessment methodology, and the development of EMP protection handbooks and specifications or military standards. Programs were developed through analysis of agency and Service needs for technology development. The methodology and tools for C³ EMP protection validations will be refined as data become available and as they apply to perform system level assessments. Work toward the development of EMP protection concepts and specifications will be continued with the goal of developing appropriate military standards and configuration management practices.

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Project #: 0

Title: Command, Control, and Communications (C³)

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

b. BASIS FOR CHANGES IN FY 1983 FROM FY 1982: The FY 1983 effort places emphasis on protection and standards development, as well as practices and procedures for hardness maintenance and surveillance. This effort was initiated in FY 1978 at embryonic program levels. Data gathered in experiments conducted under project G, Effects Simulation Using Radiation Simulators, and those obtained from feasibility experiments sponsored by other agencies, will be the principal sources of information for products to be developed under this project category, and are essential to develop a comprehensive protection strategy, and results in FY 1983 requirements under this project. Significant efforts in nuclear weapons effects on elements of C³ systems are also conducted under project S, High Altitude Phenomenology and Applications, and project I, Effects Simulation Using Natural Disturbances.

DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: P

(U) Title: Effects/Vulnerability Assessment
and Data Evaluation

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) This is a key element in the technical direction of a balanced--responsive to current Service requirements and anticipated future needs--DNA Research, Development, Test and Evaluation (RDT&E) program. Develop new ideas and advanced theoretical nuclear weapons and radiation effects concepts for application to theater and strategic policies, and enhancement of system survivability and effectiveness in a nuclear environment.

2. (U) Collect, assess, and disseminate the results of the overall DNA RDT&E program using the Department of Defense Nuclear Information and Analysis Center, and develop nuclear weapons storage site survey reports for integration of the Department of Energy's Atmospheric Release Advisory Capability into response plans for potential nuclear weapon accidents.

G. (U) RELATED ACTIVITIES: This project supports all Department of Defense activities concerned with nuclear weapons effects. Specifically, this project supports the various Military Services' requirements for nuclear weapons effects information.

H. (U) WORK PERFORMED BY: Civilian contractors and nonprofit organizations.

(U) Project #: P

(U) Title: Effects/Vulnerability Assessment
and Data Evaluation

(U) Program Element #: 6.27.15H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

1. (U) Contractors include: Analysis and Technology, Inc.; The BDM Corp.; Control Data Corp.; Kaman Sciences Corp.; Lulejian Associates, Inc.; Pacific-Sierra Research Corp.; R&D Associates; Science Applications, Inc.; and Systems Planning Corp.

2. (U) Nonprofit organization is TRI International.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS:

a. (U) Determined likely failure modes, nuclear hardening technology requirements, and hardness validation methods for the proposed Low Altitude Defense System (LOADS) design and booster.

b. (U) Identified nuclear survivability issues (electromagnetic pulse and transient radiation effects on electronics) and developed a comprehensive simulation development and technology program for the M-X design review and full-scale development.

c. (U) The Department of Defense Nuclear Information and Analysis Center (DASIAC) supported the Nuclear Test Personnel Review--a nationwide study of the lasting effects of nuclear radiation on humans, and correlated the Mt. St. Helens volcano energy release to nuclear explosions.

(U) Project #: P

(U) Title: Effects/Vulnerability Assessment
and Data Evaluation

(U) Program Element #: 6.27.15.H

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(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

d. Determined aircraft hardening requirements and developed methods to test aircraft vulnerability to blast and thermal radiation.

e. (U) Improved nuclear planning capabilities, especially in the Supreme Headquarters Allied Powers Europe by exploiting automatic data processing and a solid-state hand-held calculator.

f. (U) Targeting methodologies to increase deterrence of strategic forces were developed. Specific efforts included developing blocks of facilities which can be targeted to meet specific, limited objectives, and developing a means of rapid weapon retargeting and reallocation.

g. (U) Developed techniques to predict the response of command, control, and communications facilities to the electromagnetic pulse (EMP) produced by high-altitude nuclear detonations.

2. (U) FY 1982 PROGRAM:

a. (U) In support of the Air Force, formulate comprehensive nuclear weapons effects technology and hardness validation programs to support recent M-X decisions and identify nuclear vulnerabilities of candidate M-X command, control, and communications systems.

b. (U) Develop concepts to resolve the uncertainties in the ground shock and cratering effects of nuclear weapons.

c. (U) Recommend techniques for aircraft electromagnetic pulse hardening and hardness validation, and identify penalties for hardening new configurations (low radar cross-sections) and materials (composites).

(U) Project #: P

(U) Title: Effects/Vulnerability Assessment
and Data Evaluation

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

d. (U) Develop nuclear weapon storage site survey reports and capability to plot and rapidly display nuclear accident effects tailored to site-specific topography, demography, and geography.

3. (U) FY 1983 PLANNED PROGRAM:

a. (U) Evaluate effect of nuclear weapons on, and mitigation techniques for, emerging communications and intelligence systems (e.g., space-based synthetic aperture radars, and reconstitutable satellite systems).

b. (U) Determine the effects of atmospheric nuclear detonations on the signal propagation of very low frequency phased-array, reconstitutable extremely low frequency technologies, and infrared surveillance systems.

c. (U) The Department of Defense Nuclear Information and Analysis Center (DASIAC) will continue to analyze and disseminate information from underground and high explosive tests and laboratory simulations.

d. (U) Develop technical approaches aimed at electromagnetic pulse hardening and hardening validation for fixed and mobile ground command, control, and communications systems.

4. (U) FY 1984 PLANNED PROGRAM: Initiate new research efforts to investigate those areas of interest that result from the outgrowth of prior year efforts and new developments, both foreign and domestic, in nuclear weapon effects.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

ject #: P

(U) Title: Effects/Vulnerability Assessment
and Data Evaluation

Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

(U) MILESTONES: There is no significant change in project milestones from the January 1981 submission.

FY 1982 (U) Investigate and assess major system and policy nuclear weapons effects problems.

FY 1983 (U) Investigate areas that result from an outgrowth of prior efforts, breakthroughs in the related
ies, and new developments in nuclear weapons effects.

FY 1984 (U) Begin to develop improved design concepts for flexible response options.

		(\$ in Thousands)				
		<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COST TO COMPLETION</u>
(U) <u>RESOURCES</u> :	Effects/Vulnerability Assessment and Data Evaluation	12,192	19,057	20,300	22,347	Continuing

a. (U) BASIS FOR FY 1983 REQUEST: Support efforts in the application of nuclear weapons effects technology to
stem development and deployment. A relatively small part of the effort is applied to dissemination of the results of
eapons effects development.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1982: Programmatic progress and adjustments in overall priorities
lited in minor adjustments to the funding level for this project.

DEFENSE NUCLEAR AGENCY
FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: 2

(U) Title: High Altitude Phenomenology and Applications

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) The objective of this project is to provide the capability to evaluate the performance of and to develop mitigation techniques for communication, navigation, radar, optical and infrared systems in a nuclear environment. The nuclear disturbed atmosphere is defined and interaction of systems with that medium is assessed. Nuclear weapon debris motion and distribution and the resultant atmospheric ionization, striation, and infrared emission phenomena as a function of time are calculated. The results are compared with experimental data.

2. The objective is accomplished through a series of theoretical and modeling programs that are coordinated with the experimental programs of other projects, e.g., Effects Simulation Using Natural Disturbances. Experimental data also are obtained from past nuclear events and subsequent laboratory investigations and field measurement experiments. The results are applied to system design specifications, nuclear mitigation technique development, and models to determine system performance in various nuclear warfare scenarios.

3. (U) RELATED ACTIVITIES: This project supports Service activities by providing predictions of the effects of endoatmospheric and exoatmospheric nuclear explosions. This effort includes the use of phenomenology application codes, monitoring research in atmospheric phenomena, reporting on potential defense related problems and application, and maintaining generic handbooks and reference documents pertaining to atmospheric nuclear effects. Data provided by the project are necessary to determine the effectiveness, to assist in the design of, and to develop mitigation techniques for:

1. (U) Command, control and communications (C³) activities conducted in support of the National Command Authorities and strategic and theater nuclear forces.

(U) Project #: S

(U) Title: High Altitude Phenomenology and Applications

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #640 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

2. - sensors which give early warning of enemy missile attack. Future systems might provide damage assessment following strategic nuclear exchanges and/or other surveillance applications.

3. (U) New communications concepts employing adaptive high frequency, ground wave, and meteor burst techniques.

4. (U) Data modulation techniques that provide nuclear propagation effects mitigation without compromising electronic counter-countermeasures of advanced communication systems.

5. [

6. (U) Precursor nuclear weapon detonations which may be used by strategic missiles as a penetration aid against defended targets.

H. (U) WORK PERFORMED BY: Department of Defense (DoD) laboratories and facilities, other United States Government agencies, civilian contractors, education institutions, and nonprofit organizations.

1. (U) Principal Department of Defense agencies include Air Force Geophysics Laboratory; Naval Research Laboratory; Air Force Weapons Laboratory; and Naval Ocean Systems Center.

2. (U) Other United States Government agencies include National Oceanic and Atmospheric Administration; National Aeronautics and Space Administration; and the Institute for Telecommunications Sciences.

3. (U) Contractors include ESL, Inc.; General Electric Co.; General Research Corp.; Lockheed Missile and Space Co.; Mission Research Corp.; Science Applications, Inc.; Pacific Sierra Research Corp.; Physics Dynamics, Inc.; JAYCOR; Berkeley Research Associates; KAMAN Sciences Corp.; IRT Corp.; SRI International; and SANDIA Laboratory.

(U) Project #: S

(U) Title: High Altitude Phenomenology and Applications

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: This project has supported the development and exploitation of theoretical techniques designed to provide an understanding of the processes that follow atmospheric nuclear detonations. The performance of communication, navigation, radar, optical, and infrared (IR) systems in this environment were evaluated. Effects that can influence system performance (especially communication links and) for extended periods of time were emphasized. Computer codes developed in previous years to provide predictions of nuclear environmental data were revised, upgraded and extended in both time, spatial, and spectral capability.

2. FY 1982 PROGRAM: A three-dimensional extremely low frequency (ELF) code will be further refined. Modeling of transverse electric (TE) very low frequency (VLF) propagation is being made to support TE mode capability for present and future airborne systems. Assessment of various adaptive high frequency (AHF) trans and po. attack communication systems will continue to include candidate very high frequency (VHF) systems of interest to the Defense Communications Agency (DCA), the Minimum Essential Emergency Communications Network (MEECN), and the World Wide Command of Strategic Air Command (SAC). Evaluation of data from field experiments and nuclear tests will proceed. The results will be used to develop techniques [

Nuclear environment prediction capabilities will be upgraded for continental sized multiburst scenarios with emphasis on lower ionospheric and/or high latitude scenarios. Radar and optical systems codes for nuclear effects will be improved to include state-of-the-art radar propagation and systems models for ballistic missile and surveillance system applications. Theoretical research and field measurements of infrared (IR) structure will continue. A program will be initiated to understand and predict plasma structure in the first minutes after a high altitude nuclear explosion. This structure may influence later time signal scintillation producing structure and change current effect predictions.

3. FY 1983 PLANNED PROGRAM: The effects of off path ionospheric irregularities will be evaluated using the three-dimensional extremely low frequency (ELF) propagation code. The results of propagation experiments during solar flare disturbances

(U) Project #: S

(U) Title: High Altitude Phenomenology and Applications

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

of the ionosphere will be compared with code predictions.

Link performance investigations of selected satellite systems in nuclear scenarios will be assessed and mitigation techniques will be evaluated. Detailed comparison of field experiments and performance data will continue. Nuclear prediction programs will be extended to include a capability to calculate the effects of a burst at high altitude and high magnetic latitude. Experimental data will be evaluated. Early time plasma structure evaluation will proceed as will support of early time experiments. Multiple burst interactions will be investigated. [Emphasis on spatial spectral, and temporal aspects of infrared (IR) emissions will increase as data from IR field experiments become available during this time period. Nuclear induced emissions in the long wavelength IR (LWIR) regions between micrometers will receive prime emphasis. Measurements of a few critical atmospheric reaction rates will continue.

4. (U) FY 1984 PLANNED PROGRAM: The incorporation of field simulation results into the data base will continue. This effort will result in an improved and comprehensive prediction capability for assessing communications systems. Emphasis will be on ionospheric propagation from extremely low frequency (ELF) through very high frequency (VHF), satellite communications, navigation systems, and space based radar, as well as long wavelength infrared (LWIR) systems. Emphasis will be placed on transfer of technology to systems program offices. Mitigation techniques will be tested against predictive codes and data processing algorithms intended to be resistant to perturbations produced by nuclear effects will be devised.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES:

FY 1982: (U) Predictive code refinements include addition of dust, improved algorithms, long wave infrared (LWIR) effects, multiburst effects on satellite communications, initial incorporation of high altitude and high magnetic latitude bursts. Assessment of network degradation of low altitude air defense radars, Defense Support Program Mobile Ground Terminals and adaptive

(U) Project #: S

(U) Title: High Altitude Phenomenology and Applications

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

high frequency (AHF) communications systems. Testing of AHF systems and calculation of nuclear effects on millimeter wave radars and candidate submarine launched missile guidance update systems.

FY 1983: (U) Provide radar propagation degradation and vulnerability assessment support to the ballistic missile defense (BMD) Low Altitude Defense System (LoADs). Complete preliminary long wave infrared (IR) assessment capability and incorporate results of field experiments in predictive codes and system models. Complete Spatial and Spectral Infrared Experiment (SPIRE) data assessment and apply results to earth limb-viewing infrared systems. Calculate mission performance of selected satellite systems in multiple burst nuclear scenarios. Complete evaluations of space based radar links in nuclear environments and the development of methods to improve performance. Perform follow-on calculations for AHF systems, based on actual performance of airborne units operating in ambient environments. Refine very low frequency (VLF) extremely low frequency (ELF) spherical wave code to include a scatter model for ionization patches at D and E region altitudes. Perform follow-on calculations for adaptive high frequency (AHF) systems, based on actual performance of airborne units operating in ambient environments (New Look). Complete evaluations of AHF systems field test program showing most relevant aspects for stressed propagation environment and suggested mitigation measures.

FY 1984: (U) Design, evaluation, and mitigation of selected satellite command, control and communications (C3) radar systems will continue. Integrate results of early time structure investigations into high altitude nuclear scintillation effects codes if necessary. Complete assessment of rocketborne electron accelerator spectral data and apply results to prediction of IR emissions from heavily dosed regions. Update modeling of spectral, spatial, and temporal character of long wavelength infrared (LWIR) processes based upon data from satellite and rocket measurements. Perform follow-on calculations of AHF systems, based on actual performance of airborne units operating in ambient environments.

		(\$ in Thousands)				COST TO
	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COMPLETION</u>	
(U) <u>RESOURCES:</u> High Altitude Phenomenology and Applications	6,537	8,400	11,000	11,100	Continuing	

(U) Project #: S

(U) Title: High Altitude Phenomenology and Applications

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

a. (U) BASIS FOR FY 1983 REQUEST: Data from experimental programs will be available and will be applied to the validation of techniques used to predict nuclear weapons effects on satellite communication links, radar, infrared (IR) and other strategic and theater communications systems performance.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1982: Added emphasis has been placed on theoretical efforts in satellite communications, space based radar, operations in polar/high latitude regions, and long wavelength infrared (LWIR) areas. The remainder of the program will be at approximately the same level of effort as the previous year. This theoretical work, combined with the experimental data from Project I, will permit the prediction of nuclear effects on developing communications and surveillance systems as well as space and ballistic missile defense systems. The predictions will aid in system design, nuclear capability assessment and nuclear mitigation development.

DEFENSE NUCLEAR AGENCY
FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: I (U) Title: Laboratory Radiation Simulator Development
(U) Program Element #: 6.27.15.H (U) Title: Defense Nuclear Agency (DNA)
(U) DoD Mission Area: #540 - Defense Nuclear Agency (U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION: The overall objective of this project is to provide laboratory radiation sources to support design, development, and testing of strategic missiles, satellites, and ground-based communication systems, from the piece part through the full-scale system level. These weapons effects simulators are used to demonstrate that systems meet their hardness and survivability specifications. The most important radiation effects to be simulated are caused by X-rays. They include thermo-mechanical shock, high-altitude electromagnetic pulse (EMP) effects, system generated EMP (SGEMP), ionization effects, and source region EMP (SREMP). This project includes construction and operation of laboratory radiation sources and development of technology for more advanced facilities.

G. (U) RELATED ACTIVITIES: Radiation testing of components and systems is also performed using underground nuclear tests (UGTs). UGTs are the preferred testing method when high X-ray fluences are required over large areas, and when a small number of data points is sufficient.

H. (U) WORK PERFORMED BY: Department of Defense agencies; civilian contractors; and educational institutions.

1. (U) Principal Department of Defense agencies include the Air Force Weapons Laboratory; United States Army Harry Diamond Laboratories; and the Naval Research Laboratory.

2. (U) Contractors include Advanced Research and Applications Corp.; JAYCOR, Inc.; Lockheed Palo Alto Research Laboratory; Maxwell Laboratories, Inc.; Physical Dynamics, Inc.; Physics International Co.; Pulsed Sciences, Inc.; R&D Associates; Science Applications, Inc.; and Systems, Science and Software.

(U) Project #: I

(U) Title: Laboratory Radiation Simulator Development

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

3. (U) Educational institutions include the University of California (Lawrence Livermore National Laboratory and Irvine).

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: For the past several years, plasma heating techniques have been examined for production of soft X-ray yields. The overall goal is to develop laboratory X-ray sources capable of testing satellites for prompt X-ray effects, particularly system generated electromagnetic pulse (SGEMP). Most existing laboratory radiation sources employ the bremsstrahlung process for X-ray production whereby X-rays are produced by the sudden deceleration of electrons as they impact a metallic target. This process is relatively inefficient for generating low energy (soft) X-rays because the production efficiency decreases markedly as the energy of the incident electrons decreases. For this reason, the advanced simulation program has emphasized other means of X-ray production which are not necessarily limited to the low energy conversion efficiencies -- less than one percent of incident electron beam energy -- associated with the bremsstrahlung process at the energies of interest. One alternative method utilizes the physics of radiating high temperature plasmas. A plasma is formed by electrically heating an array of wires or a puff of gas between the electrodes of a high power generator. This technique has produced X-ray yields with sufficient intensity and proper spectral quality to satisfy the goals of the Satellite X-ray Test Facility program.

a. X-ray outputs [] are required to satisfy the BACCARAT long-term simulation objectives. One means of producing these extremely high yields is

Such advanced concepts require ultra high power energy sources to produce the required input conditions at the pellet target. These energy sources may be several years away from reality. Using the same type of plasma X-ray sources developed for satellite testing, but with a softer spectrum, X-ray yields of more than [] have been produced to implode pellets. Experiments were conducted in both FY 1978 and FY 1979 utilizing this driver on both glass and plastic pellet targets filled with a mixture of deuterium and tritium. These soft X-ray yields have

(U) Project #: T

(U) Program Element #: 6.27.15.H

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Title: Laboratory Radiation Simulator Development

(U) Title: Defense Nuclear Agency (DNA)

(U) Budget Activity: #1 - Technology Base

also been used directly to test small samples of reentry vehicle materials. Intense ion beam sources were also developed to implode pellets and for direct simulation of thermomechanical effects in materials.

b. (U) A vigorous program of advanced pulsed power development has been pursued during the past several years to provide the technology required to permit the design and construction of more advanced and powerful electrical generators. Such machines are necessary to drive advanced simulation concepts experiments to levels where the viability of different X-ray production techniques for BACCARAT applications can be established. The PITHON superpower generator, initially a 4-terawatt (4×10^{12} watts) machine, became operational in early FY 1976. The 6-terawatt BLACKJACK 4 generator, first operational in early FY 1977, was upgraded to the 12-terawatt BLACKJACK 5 level in late FY 1978, and is presently the most powerful low-impedance machine in the world. Pulsed electrical generators with output powers of approximately 100 terawatts (100×10^{12} watts) may be required to power X-ray sources capable of exposing reentry vehicle systems to threat-level fluences. Inductive storage of energy is more compact, and, in principle, less expensive than capacitive energy storage of the high energies necessary for pulsed power systems. Numerous inductive concepts employing homopolar generators have been successfully demonstrated over the past decade. However, the primary difficulty in applying inductive storage to high-voltage, short-pulse systems has been the inability to design a switching element capable of carrying current for the relatively long times needed to charge the inductor and then open against high voltages, in the short times necessary for effects testing applications ($100\text{--}200 \times 10^{-9}$ seconds). An inductively driven test bed was fabricated in FY 1978 to evaluate advanced switching techniques. A combined explosive switch/foil fuse/wire fuse performed well in tests up to the 100-kilojoule level. More recently, the homopolar generator inductive/inertial energy storage system has been utilized to test surge arrestors that have been designed to protect certain systems against source region electromagnetic pulse (SREMP) effects. The homopolar system has provided a very low-voltage, moderate current, high-energy (approximately one megajoule), long-duration (several milliseconds) pulse to stress the surge arrestors to levels beyond their design limits. Simulators for M-X in-place testing have been designed and are being procured. The development of high-intensity, large-area electron beam sources for combined thermal/structural testing of systems, such as the M-X shroud and the TRIDENT II missile, will continue. Plans are underway to modify the diodes of the PITHON and BLACKJACK 5 generators to provide high-voltage, megajoule, large-area (1-2 square meters) electron beams for such applications.

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(U) Project #: T

(U) Title: Laboratory Radiation Simulator Development

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

2. (U) FY 1982 PROGRAM: X-ray testing in support of both M-X and advanced ballistic reentry systems (ABRES) will be conducted utilizing the plasma radiator sources developed for the Satellite X-ray Test Facility (SXTF). Small cassettes will be tested for system generated electromagnetic pulse (SGEMP) effects on M-X missile-in-flight piece parts, and screening experiments will be conducted on candidate M-X reentry vehicle heatshield material specimens. Attempts will be made to markedly harden the spectral content from plasma radiators by investigating the use of both stainless steel wires and krypton gas. Pellet implosion experiments will be conducted on the BLACKJACK 5 generator at power levels in excess of 10 terawatts (10×10^{12} watts). Advanced pulsed power technology will continue to be developed to permit the design and construction of high current generators in the 30-40 terawatt ($30-40 \times 10^{12}$ watts) range that will serve as useful driving sources for both plasma radiator and pellet compression experiments at higher power levels. A segment of a proposed 30-terawatt modular system is presently under construction and will be tested to demonstrate basic proof-of-principle feasibility. The BLACKJACK 5 generator is being modified to provide higher current, lower impedance output. The last pulse-forming sections will be convoluted into two parallel outputs which then must be recombined in the vacuum diode. If successful, this will provide an opportunity to conclusively determine whether peak current, or peak power, is the dominant scaling parameter for radiative yields from plasma loads. The TRIDENT II inertial/inductive energy storage system will be operated at the full design level of 1 terawatt. Higher power modules of up to 12 terawatts will be designed which, in turn, will identify additional experimental work required on homopolar generator development such as voltage hold-off, brush current density, and rotor speed. The construction of the two M-X simulators will be completed, and testing will begin.

3. (U) FY 1983 PLANNED PROGRAM:

a. (U) X-ray testing of M-X reentry vehicle material specimens and SGEMP testing of M-X missile-in-flight piece parts will continue utilizing argon puff gas and calcium wire plasma radiators. The upgrade of the BLACKJACK 5 generator to the 16-20 terawatt ($15-20 \times 10^{12}$ watts) level employing a partial pulse-line convolute will be completed in late FY 1982, and the first plasma radiator photon experiments will be conducted at those elevated power levels with significant radiative yields anticipated from stainless steel wires and krypton gas. Work will start on the design and construction of a 30-terawatt (30×10^{12} watts), high-current generator suitable for driving advanced simulation concepts experiments to higher levels of interest. Either the fully

(U) Project #: T

(U) Title: Laboratory Radiation Simulator Development

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

modular or the hybrid (single machine/partially modular) pulsed power generator concept will be selected dependent upon the results of the tri-plate modularized segment experiments and the BLACKJACK 5 convolute tests. Inductive/inertial storage systems delivering up to 10 megajoules of energy will be designed for surge arrestor testing and for excitation of buried cables. The source region electromagnetic pulse (SREMP) simulator will be employed in tandem with an early time field illuminator system, developed by the Air Force, to test the M-X medium-frequency antenna for SREMP effects.

b. (U) Extensive BACCARAT classified concept experiments will be conducted on the BLACKJACK 5 generator at elevated power levels (15-20 terawatts) after the upgrade has been completed. High-voltage and high-power ion beam experiments will be conducted utilizing one or more arms of the conventional AURORA machine modified for maximum ion beam generation.

4. (U) FY 1984 PLANNED PROGRAM: The construction of a higher-power, 30-terawatt (30×10^{12} watts), low-impedance pulsed power generator as a driving source for laboratory radiation simulator experiments will be completed by the close of FY 1984. Plasma radiator source development experiments will continue to be performed utilizing the upgraded BLACKJACK 5 generators. Higher yields from argon gas and meaningful harder spectral content outputs from stainless steel wires and krypton gas will enhance the capability to perform meaningful X-ray and system generated EMP (SGEMP) missile-in-flight experiments in support of M-X and other prospective users. Combined thermal/structural effects testing of the M-X shroud will be performed utilizing the high-intensity large-area electron beam sources recently developed. Classified BACCARAT concept experiments will be conducted at the 15-20 terawatt ($15-20 \times 10^{12}$ watts) power level on BLACKJACK 5 and should produce data that indicates whether anomalous losses and other unexplained problems associated with the basic inertial confinement fusion approach can be circumvented. The late-time SREMP simulator will continue to be utilized to support the M-X program as directed by the Ballistic Missile Office. The inertial/inductive energy storage technology will continue to be investigated for excitation of buried cables and surge arrestor testing.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

(U) Project #: T

(U) Title: Laboratory Radiation Simulator Development

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

6. (U) MILESTONES: Changes in milestones from the January 1981 submission are attributable to the decision to continue the development of advanced pulsed power technology to design a lower-risk, more economical, high-power machine, the decision to develop high-intensity, large-area electron beam sources, and to concomitantly deemphasize inertial confinement fusion experiments; and the decision to build two different pulsed power systems to support M-X source region electromagnetic pulse (SREMP) testing.

FY 1982 (U) Perform X-ray testing of candidate M-X reentry vehicle heatshield materials on the BLACKJACK 5 generator. Perform phenomenology experiments to determine system generated EMP (SGEMP) effects on the M-X missile in-flight. Continue developing X-ray sources for pellet implosion experiments on the BLACKJACK 5 generator. Conduct focused ion beam experiments at high power levels utilizing the AURORA generator. Complete the upgrade of the BLACKJACK 5 generator to include a partial convolute of the water pulse-line system. Complete the checkout and proof-of-principle demonstration for the first module of the modular simulator concept. Operate the inertial/inductive energy storage system at output powers of 1 terawatt (1×10^{12} watts). Complete the fabrication of simulators for M-X validation testing applications. Begin the development of high-intensity, large-area electron beam sources for combined thermal/structural testing of reentry vehicle and missile systems.

FY 1983 (U) Continue to perform X-ray and SGEMP missile-in-flight tests in support of M-X. Begin the construction of a 30-terawatt, low-impedance generator. Test the M-X shroud for combined thermal/structural effects utilizing the newly developed, high-intensity, large-area, electron beam sources. Perform validation testing of the M-X shelter and medium-frequency antenna utilizing the 3-4 megajoule SREMP simulator. Continue the development of plasma radiator photon sources by conducting experiments at elevated power levels. Begin classified pellet compression experiments on the upgraded BLACKJACK 5 generator. Design inertial/inductive storage systems for buried cable testing.

FY 1984 (U) Complete the construction of a 30-terawatt, low-impedance generator. Continue X-ray testing of M-X reentry vehicle piece parts. Continue electron beam thermal/structural testing of missile and reentry vehicle systems. Continue the

(U) Project #: T

(U) Title: Laboratory Radiation Simulator Development

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

development of plasma radiator photon sources of elevated power levels. Continue pellet compression experiments at elevated power levels. Conduct focused ion beam/planar target experiments on the high-voltage AURORA generator. Use the 3-4 megajoule source region electromagnetic pulse (SREMP) simulator to support M-X testing. Use the inertial/inductive storage system for surge ar-restor and buried cable testing.

		(\$ in Thousands)				
		<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COST TO COMPLETION</u>
7. (U) <u>RESOURCES:</u>	Laboratory Radiation Simulator Development	14,758	12,200	19,800	18,400	Continuing

a. (U) BASIS FOR FY 1983 REQUEST: The FY 1983 request will support four general areas. Approximately 40 percent will be used to upgrade existing pulsed generator output capabilities and to develop a high-intensity, hot-filtered X-ray source. Nearly 20 percent will be used to develop plasma radiator X-ray sources and to support X-ray and SREMP testing for M-X. Approximately 10 percent will be spent on development of experimental techniques capable of producing BACCARAT-level photon sources. The remainder will be spent on the development of a transportable SREMP simulator for testing of Army tactical systems.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM 1982: The increase in FY 1983 will be employed to develop a transportable SREMP simulator capable of testing Army tactical systems at levels of interest and to complete the development of a high-intensity, hot-filtered X-ray source for thermomechanical effects testing of inertial guidance systems.

DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(THIS SUMMARY IS UNCLASSIFIED)

Title: Biomedical Effects Research

Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

Mission Area: #540 Defense Nuclear Agency

Budget Activity: #1 - Technology Base

BACKGROUND AND DESCRIPTION:

This project provides data on the biological effects of nuclear weapons on the operational and medical aspects of military responses of personnel to radiation and blast are determined, the basis for responses are investigated, and methods for responses are developed. Information obtained enables prediction of personnel combat task performance decrements and casualty and risk criteria related to weapon employment, provides means to prevent, delay or treat the nuclear defines the extent of long-term health effects related to low-level radiation exposures.

is accomplished through experimental research programs, development of models for extrapolating laboratory results to national impacts, and evaluation and analysis of limited human information on nuclear weapons effects. Experimental defined using laboratory animal models ranging from cells through intact species subjected to simulated nuclear environment data form the basis for algorithms and mathematical models to predict the response of man as a function of task and exposure conditions. Former Department of Defense participants in the 1945-1962 atmospheric nuclear tests are their radiation doses determined, and the subsequent health experience of a significant sample evaluated.

ACTIVITIES: This project supports Service needs for information on the biological effects of nuclear environments for through employment sequence. Planning for military operations requires information on individual and unit performance as a function of radiation dose, dose rate, and quality, time after exposure, and task complexity. Medical support for

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Project: U

Title: Biomedical Effects Research

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 Defense Nuclear Agency

Budget Activity: #1 - Technology Base

exposed persons requires a means of determining the exposure type, other injuries and best therapeutic measures. This project provides biological data and technology for operational and medical planning.

H. WORK PERFORMED BY: Department of Defense and government Laboratories, nonprofit organizations, educational institutions and civilian firms.

1. Principal DoD Laboratory is the Armed Forces Radiobiology Research Institute (AFRRI).

2. Non profit organizations include the Lovelace Biomedical and Environmental Research Institute, Inc., Air Force School of Aerospace Medicine, the National Academy of Sciences, National Research Council, and the University of Utah.

3. Contractors include Kaman-TEMPO, Science Applications, Inc., JRB Associates, JAYCOR, Reynolds Electrical and Engineering Co., Inc., and Advanced Research and Applications Corp.

1. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: Previous research has centered on defining radiation effects on performance capabilities of individuals, determining the basis for performance decrement, developing treatment procedures for individuals irradiated in mid-lethal ranges and documenting and evaluating DoD involvement in the atmospheric nuclear weapons tests. The quantitative and qualitative responses of animals subjected to simulated weapons radiation spectra have been obtained and used to predict exposure levels that will result in early transient incapacitation and permanent complete incapacitation for 50 percent of personnel so exposed. Increased production and release of body biochemical substances and release of altered body cellular constituents have been identified as a possible basis for decrement in nervous system integrity and decremented performance. An educational program in nuclear weapons phenomenology and biological effects was presented to operational and medical personnel, students at Service Academies, the Uniformed Services University of Health Sciences, and reserve units. Progress was made in the Nuclear Test Personnel

Project: U

Title: Biomedical Effects Research

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Review (NTPR) program identifying Department of Defense participants in the atmospheric nuclear tests, determining their radiation exposures and health experience since test participation, and documenting the activities performed during the tests.

2. FY 1982 PROGRAM: The Military Services require information concerning individual and unit performance degradation following radiation exposures and the effect of partially degraded performance upon combat effectiveness. Animal models will be used to quantify levels of radiation-induced performance degradation for specific tasks as a function of dose and quality, task complexity, combined stresses, and time after exposure. The data will be correlated with combat task analysis to predict individual ineffectiveness and extended to include predictions for units or crews. Blast biology studies will address the response of personnel as a function of pressure wave characteristics to enhance casualty prediction techniques. Military Medical Departments need effective procedures to determine the level of radiation exposure for individuals and for treating injured personnel. Biochemical mechanisms responsible for radiation-induced injury in the central nervous system (brain), gastrointestinal system (gut) and hematopoietic system (blood) will be determined and will provide a basis for estimating, under field conditions, exposure levels and degree of injury. The results will be key to developing methods for treating radiation injury; the approaches to improved therapy procedures and preventive means involve restoring critical body cells, preventing secondary bacterial infections, and increasing the effectiveness of antidotes or radioprotectant compounds. DoD and the Military Services need information about long-term health effects following low-level radiation exposures. The estimated 200,000 DoD participants in the 1945-1962 atmospheric nuclear test series will be identified, their radiation doses determined, and the health experience of a sample evaluated to determine if there is an increased incidence of disease among them, and if so, whether it can be related to radiation received during the testing; the circumstances of exposures will be documented in reports. Operational and medical military personnel need information on the phenomenology and biological effects of nuclear weapons. An educational program in the medical effects of nuclear operations will be presented to appropriate military personnel, and will be updated continually with results from research programs.

3. FY 1983 PLANNED PROGRAM: The FY 1982 research program will continue, with emphasis on unit performance degradation, injury, and protection against and mitigation of deleterious effects. Levels of exposure involved in the research program will become lower, as the threshold for radiation-induced performance degradation is approached. The Nuclear Weapons Effects model will be used

Project: U

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to predict combat ineffectiveness, radiation sickness and other time dependent effects of radiation exposure. Work on combined effects will be expanded. The role of altered cellular constituents in producing radiation injury will be established and applied for developing biological dosimetry. Research on treatment of individuals exposed to lethal radiation levels will continue to focus on enhancing recovery of remaining critical cells and more effective means of replacing depleted cells. Current blast casualty criteria will be evaluated and revised where appropriate and additional research initiated concerning secondary projectile injuries. The research for the histories of Department of Defense activities in the atmospheric nuclear tests will be completed, most reports will be published, and identification of participants and their doses will continue along with the health experience survey of the sample.

4. FY 1984 PLANNED PROGRAM: The FY 1983 program will continue. The influence of physical and mental stresses on performance decrements and the combined effects of chemicals and radiation will be evaluated. Research on enhanced therapy procedures for injury will include efforts to counteract immune responses and to enhance the permeability of cells to protective compounds. Biological dosimetry efforts will continue. The final reports of DoD involvement in the atmospheric nuclear tests will be published, all participants will be identified and their doses determined, and the health experience survey results evaluated.

5. PROGRAM TO COMPLETION: This is a continuing program.

6. MILESTONES:

- FY 1982
- a. Continue to quantify radiation-induced performance degradation and continue on-going long-range programs.
 - b. Implement program to determine unit combat ineffectiveness for operational situations.
 - c. Continue developing biological dosimetry techniques using biochemical constituents.
 - d. Develop improved procedures to store and preserve blood cells for use in post-irradiation treatment.

Project: U

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Budget Activity: #1 - Technology Base

- e. Complete research on Department of Defense activities in the atmospheric nuclear tests and publish reports.

FY 1983 a. Determine threshold levels for radiation-induced performance degradation for unit combat tasks and combine this data with the effort on combined effects of radiation injury and stresses.

b. Determine biochemical characteristics of radiation-modified substances for biological dosimetry and test methods to obtain high volume blood cell isolation and preservation.

- c. Evaluate blast casualty criteria prediction tables.

d. Complete identification of DoD participants in atmospheric nuclear tests and continue health experience surveys.

FY 1984 a. Continue on-going long-range programs and incorporate additional data into the Comprehensive Personnel Nuclear Weapons Effects Model to predict and describe expected effects on combat personnel with combined effects.

b. Develop animal models to determine postirradiation infection processes and role of cellular mechanisms in recovery of radiation injury and begin screening radioprotectant compounds for effectiveness and toxicity.

- c. Develop biological dosimetry procedures.

d. Complete determination of doses for DoD participants in atmospheric nuclear tests and continue health experience survey. Determine dose-response curve for long-term effects and impact on current operations with nuclear weapons.

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Title: Biomedical Effects Research

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

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	(\$ in Thousands)				COST OF
	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COMPLETION</u>
7. <u>RESOURCES:</u> Biomedical Effects Research	12,484	15,400	16,300	17,100	Continuing
a. <u>BASIS FOR FY 1983 REQUEST:</u> To support: (1) continued efforts to define and quantify effects of blast, thermal, and ionizing radiation upon man, determine how the effects are caused, and develop means to modify them; (2) continued evaluation of data pertaining to medical effects for former Department of Defense participants in atmospheric nuclear weapons tests; (3) improve ment and expansion of the program to disseminate knowledge of the medical aspects of nuclear weapons effects among medical and operational military personnel; and, (4) investment in equipment necessary to conduct research with sensitivity and precision required.					
b. <u>BASIS FOR CHANGE IN FY1983 FROM FY 1982:</u> To initiate instrumentation upgrade. Funding in recent years has not been adequate to acquire state-of-the-art equipment. These acquisitions are essential and cost effective to the continued conduct of progressive and efficient radiobiological research.					

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DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: V

(U) Title: Tactical Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION: The objective of the Tactical Systems Vulnerability and Hardening Project is to provide enhanced capabilities to United States and Allied commanders of theater nuclear forces. This DNA goal will be satisfied by increasing the United States and Allied ability to plan the employment of nuclear forces and by identifying those improvements to the nuclear forces that will place enemy forces at increased risk. The project is designed to provide an understanding of the capabilities of enemy conventional and nuclear forces which threaten Europe and Asia and identifying specific opportunities for countering these forces with conventional and nuclear firepower. By improving our understanding of nuclear weapon effects and integrating this data into improved nuclear planning techniques, the optimized attack of high leverage enemy targets can be accomplished while minimizing collateral damage. Alternative nuclear weapon systems are evaluated for their cost vis-a-vis effectiveness. Specific improvements to the Allied and United States command, control communications, and intelligence (C3I) infrastructure supporting theater nuclear forces will be identified thereby enhancing effectiveness, responsiveness, and survivability.

G. (U) RELATED ACTIVITIES: The Tactical Systems Vulnerability and Hardening project emphasizes research programs designed to directly support the requirements of United States and Allied theater commanders and numerous Department of Defense (DoD) activities: Office of the Assistant to the Secretary of Defense (Atomic Energy); Office of the Director, Net Assessment; Office of the Under Secretary of Defense for Research and Engineering; Special Assistant to the Secretary for North Atlantic Treaty Organization (NATO) Affairs; Joint Chiefs of Staff (JCS); the Defense Agencies; Departments of the Army, Navy, and Air Force, Supreme Headquarters, Allied Powers Europe and all subordinate commands; United States European Command and all subordinate commands; United States Pacific Command; NATO Nuclear Planning Group; and the Department of Energy. The project utilizes nuclear weapon effects vulnerability and hardening data from other DNA research as it pertains to aircraft, missile systems, communications, command posts, ships and support bases.

(U) Project #: V

(U) Title: Tactical Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

H. (U) WORK PERFORMED BY: Department of Defense (DoD) agencies, civilian contractors, educational institutions and nonprofit organizations.

1. (U) Principal DoD agencies include United States Army Ballistic Research Laboratory; and Naval Surface Weapon Center.

2. (U) Contractors include Atmospheric Sciences Associates, BETAC, The BDM Corp., Holifield National Lab (Union Carbide Corp.) JAYCOR, Pacific-Sierra Research Corp., R & D Associates, Science Applications, Inc., Systems, Science, and Software, Inc., TRW, Inc., Vector Research, Inc., System Planning Corp., Horizons Technology, Inc., and ORI.

3. (U) Educational institutions include University of California (Los Alamos National Laboratory/Lawrence Livermore National Laboratory) and Naval Post Graduate School.

4. (U) Nonprofit organizations are SRI International and the Institute for Defense Analyses.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS: Much of the DNA research activity has been directed at an evaluation of alternative nuclear weapon systems, force mixes, and nuclear weapon doctrines and the development of planning aids for the employment of nuclear weapons. DNA has provided comparisons of alternate missile and aircraft theater nuclear force postures. An analytical technique has been developed which will quantitatively assess the effectiveness of alternate nuclear weapon geographical distributions. DNA also investigated the capabilities of United States theater forces to fight on the integrated battlefield. This research has quantitatively demonstrated the value of enhanced air-to-ground coordination and timely command/control in nuclear weapons employment. DNA has addressed current fleet capabilities and the potential of advanced technology for fighting and enduring in maritime theater nuclear environment. Basic nuclear weapons effects related to the entire theater battlefield

(U) Project #: V

(U) Title: Tactical Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

have continued to receive attention because of their importance to the planning or possible use and control of the theater nuclear weapons. Automated techniques have been developed to enable targeteers to plan in near real time the employment of weapons against fixed installations and mobile forces.

2. FY 1982 PROGRAM: The DNA Tactical Systems Vulnerability and Hardening project will continue to place emphasis on satisfying requirements of operational commanders and staff planners. Included in the project will be the development of automated planning aids to assist in evaluating alternate force assessments and in optimizing nuclear weapon environment.

DNA will continue to point out improved deployment of weapons, target acquisition requirements, preplanning and real time nuclear weapon employment against high leverage mobile and fixed targets. The keystone of this effort is improving automated targeting tools for nuclear weapon planners. Incorporation of near real time target location information will allow weapon employment against the optimum target. This project will recommend the Allied and United States commanders the order of priority that should be ascribed to striking enemy installations, activities, and forces with nuclear weapons. Particular attention will be directed to evaluating the capability of United States theater nuclear forces. This research will allow the identification of near term and long-range improvements which should be made to nuclear forces.

In addition, DNA will investigate arms control issues with particular emphasis on force modernization activities that would allow for alternate force limitation approaches.

3. (U) FY 1983 PLANNED PROGRAM: The DNA theater nuclear warfare program will continue to pursue research that supports nuclear forces modernization and enhancement of military effectiveness and force survivability in a combined conventional and nuclear warfare environment. This goal will continue to be supported by programs in the following areas:

a. (U) The effects of nuclear weapon employment on enemy capabilities to improve our confidence in assigning vulnerability criteria to these forces.

(U) Project #: V

(U) Title: Tactical Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

b. (U) The assessment of alternate short- and mid-range nuclear systems.

c. (U) An identification of the technological and operational improvements required to support selected theater nuclear options.

d. (U) The development of automated targeting techniques that will allow near real time employment of nuclear weapons.

e. (U) The synthesis of nuclear weapons effects data in a form suitable for use by operational planners. Particular emphasis will be placed on updating fallout prediction techniques.

4. (U) FY 1984 PLANNED PROGRAM: Assist commanders and planners in determining how to use nuclear and conventional weapon systems in concert to achieve the best military effects on an integrated nuclear-conventional battlefield/maritime engagement. Continue the identification and investigation of exploitable enemy vulnerabilities to nuclear weapons. Continue to conduct the research required in weapon effects that will enable planners to more effectively employ nuclear weapons to achieve their military objectives. Identify and develop the computer software necessary to optimize the near real time employment of nuclear weapons in the prosecution of a war. In addition, identify and field test computer hardware and software that will enable planners to rapidly develop war plans or small unique options.

5. (U) PROGRAM TO COMPLETION: This program will continue to be responsive to the requests and needs of the Commanders-in-Chief, agencies, and United States/North Atlantic Treaty Organization elements discussed earlier in related activities.

6. (U) MILESTONES:

FY 1982 a. (U) Recommendations for enhancing the effectiveness of United States naval forces fighting in a nuclear environment.

b. (U) Automation of nuclear weapon employment planning to allow near real time targeting.

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(U) Project #: V

(U) Title: Tactical Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

c. (U) Definition of alternative methods of enhancing air-to-ground coordination of nuclear weapon usage on the battlefield.

d. (U) Prioritization of enemy fixed installations and mobile forces.

FY 1983 a. (U) Upgraded nuclear weapons effects data into employment planning tools.

b. (U) Recommendations for improving Pacific area nuclear weapon command, communication and control.

c. (U) Definition of alternate theater nuclear operational concepts.

d. (U) Enhanced Pacific Theater nuclear targeting capability.

e. (U) Assessment of requirement for a nuclear Corps Support Weapon System.

FY 1984 a. (U) Support theater commanders in assessing capabilities/vulnerabilities and targeting of fixed and mobile targets.

b. (U) Continue assessments of Soviet military forces, doctrine, and training.

c. (U) Continue support to Services concerning tactical nuclear doctrine and force structure issues.

(U) Project #: V

(U) Title: Tactical Systems Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 Technology Base

		(\$ In Thousands)				
		<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COST TO COMPLETION</u>
7. (U) <u>RESOURCES</u> :	Tactical Systems Vulnerability and Hardening	25,022	20,800	21,000	21,200	Continuing

a. (U) BASIS FOR FY 1983 REQUEST: Major efforts include identification of means to enhance the capabilities of Allied military commanders to deter aggression and control escalation by assisting in the development of technological improvements and credible flexible response to counter enemy threats and blunt attacks.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1984: There is essentially no change in the funding level for this project. Effort being redirected at lower level for European Command and adding major support to Pacific Command.

DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: K

(U) Title: Strategic Nuclear Implications and Assessments

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) The goals of this project are to recommend alternative United States strategic weapon employment objectives; to provide increased understanding of the relationship between nuclear weapon effects and strategic nuclear employment objectives; and to develop techniques for planning the application of nuclear weapons necessary to carry out national strategic objectives.

2. (U) Alternative strategic nuclear weapon employment policies and procedures will be evaluated vis-a-vis varying conflict situations as well as generated or degraded force postures. This research will examine an enhanced flexible planning capability that will provide the Joint Chiefs of Staff and the nuclear Commanders-in-Chief with more flexible weapon employment options. Additional research efforts will examine the alternative uses of strategic nuclear forces against all aspects of the Soviet military force structure, political, governmental, and economic installations and activities in order to apply nuclear weapons most effectively. Finally, research efforts will also define target damage objectives and damage criteria in order to correctly apply nuclear weapons. The number of installations and activities which must be targeted by strategic nuclear forces demands computerized tools. These automated techniques must account for target priority, size, vulnerability, and adjacent installations as well as United States nuclear weapon systems characteristics.

3. (U) RELATED ACTIVITIES: This project is directly related to Department of Defense (DoD) supported activities involving strategic nuclear weapon employment planning.

H. (U) WORK PERFORMED BY: DoD Agencies, civilian contract research firms, and nonprofit organizations.

(U) Project #: X

(U) Title: Strategic Nuclear Implications and Assessments

(U) Program Element #: 6.27.15.E

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

1. (U) Contractors include the EDM Corp., Science Applications, Inc., TRW-Defense and Space Systems Group; Systems Planning Corp.; LOGICON, GTE Sylvania, and Horizons Technology, Inc.

2. (U) The nonprofit organization utilized is SRI International.

1. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: Project results have provided defense planners with detailed examinations of key United States vulnerabilities brought about by protracted nuclear conflict. A comprehensive framework to include sets of plans, candidate target sets and alternative employment options has been developed to provide increased flexibility in nuclear weapon employment planning. Essential force status requirements, minimum essential planning functions, and critical command/control elements necessary for near-real time retargeting of strategic nuclear forces were identified. Alternative sensor systems for target acquisition and classification were developed. Automated tools for the optimum application of nuclear weapons to alternative target data bases were provided to nuclear planners.

2. (U) FY 1982 PROGRAM: The FY 1982 program will investigate nuclear weapon employment policies and concomitant employment; develop automated techniques for optimized weapon employment; and develop capabilities for nuclear weapon employment in intratheater war scenarios. Areas to receive attention are as follows:

a. (U) Examine the implications of protracted nuclear conflict on strategic nuclear force development, planning and operations.

b. (U) Determine optimum enduring nuclear force requirements.

c. (U) Develop analytical techniques for implementing flexible employment planning.

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OFFICE OF THE SECRETARY OF DEFENSE WASHINGTON DC F/O 5/1
JUSTIFICATION OF ESTIMATES FOR FISCAL YEAR 1983 SUBMITTED TO CO--ETC(U)
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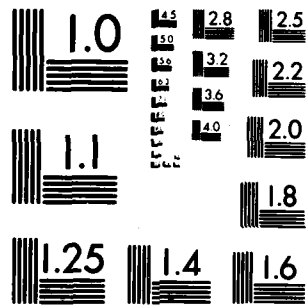
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(U) Project #: X

(U) Title: Strategic Nuclear Implications and Assessments

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

- d. Develop operational concept for utilizing national technical means to acquire, classify and target [] systems.
 - e. (U) Develop analytical techniques for describing the relationship between military targets and nuclear weapons effects.
 - f. (U) Improve nuclear weapon effects simulation in targeting and allocation models to allow more rapid development and evaluation of nuclear weapon employment options.
 - g. (U) Determine impact of nuclear weapon proliferation on United States strategic employment planning.
3. (U) FY 1983 PLANNED PROGRAM: Continued support is planned for Department of Defense planners and decisionmakers on technical issues in nuclear weapon effects and alternative nuclear employment options. Specifically, research results will be directed to allow for optimally implementing guidance cited in the Policy Guidance for Employment of Nuclear Weapons and Joint Strategic Capabilities Plan Annex C - Nuclear. Specific examination of nuclear weapons effects technology for enduring strategic force requirements and nuclear weapons effects environments during protracted nuclear conflict will provide essential information.
4. (U) FY 1984 PLANNED PROGRAM: To assist the Office of the Secretary of Defense, Net Assessment, and Deputy Under Secretary of Defense for Policy Planning in the identification, development, examination and assessment of alternative nuclear weapon employment options and strategic nuclear force capabilities in support of national strategic employment planning requirements. Using increased technical knowledge from nuclear weapons research and nuclear weapons effects testing, the program will assess the impact on alternative options. Technological improvements in advanced automated planning support systems will provide national strategic policy decisionmakers with those critical factors which contribute to the deterrent posture and increased operational readiness, capabilities and effectiveness of United States strategic nuclear forces.
5. (U) PROGRAM TO COMPLETION: The Strategic Nuclear Implications and Assessment Project will conduct the research needed to integrate nuclear weapon effects information into techniques for optimizing the application of strategic nuclear weapons. The project will continue until these methods are developed and appropriate results disseminated to nuclear weapons employment planners.

Project #: W

(U) Title: Strategic Nuclear Implications and Assessments

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

6. (U) MILESTONES:

- FY 1982 a. (U) Define the implications of alternative protracted conflict scenarios on flexible employment planning, battle management control and assessment, and force utilization objectives.
- b. (U) Develop enduring strategic force requirements.
- c. (U) Complete preliminary design of flexible employment planning technique.
- d. Continue examination of utilization of national technical means for target acquisition, classification, and weapon system targeting against [redacted] system.
- e. (U) Complete preliminary design of a mobile stand-alone facility that will provide a nuclear weapon employment planning capability.

f. Initiate an evaluation of [redacted]

FY 1983 a. (U) Continue assessment of factors designed to enhance strategic force endurance.

b. (U) Complete development of flexible employment planning concept.

c. (U) Complete developments of automated nuclear planning aids.

d. Continue examination of alternative concepts in use of national technical means for targeting [redacted] systems.

e. Evaluate [redacted] planning facility.

(U) Project #: W

(U) Title: Strategic Nuclear Implications and Assessments

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

- FY 1984 a. (U) Complete examination of protracted nuclear conflict on strategic force development, operations, and employment planning.
- b. Complete examination of use of national technical means in targeting of [redacted] systems.
- c. (U) Identify requirements and capabilities required for survivable and enduring battle management and control systems.
- d. (U) Complete development of flexible planning techniques.

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COST TO COMPLETION</u>
(U) <u>RESOURCES:</u> Strategic Nuclear Implications and Assessments	4,011	4,500	5,300	5,100	Continuing

a. (U) BASIS FOR FY 1983 REQUEST: Continuing requirements from the Office of the Secretary of Defense and from the Joint Chiefs of Staff.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM 1982: The Policy Guidance for Employment of Nuclear Weapons has placed emphasis on requirements for enduring, survivable and flexible strategic nuclear forces and supporting planning systems. The FY 1983 research program will permit a significant increase in research efforts associated with changes in national strategic policy and employment guidance. In particular, emphasis will be placed on defining force capabilities and alternative strategies for conducting protracted warfare. Complementing this work will be the development of techniques that will allow strategic nuclear commanders to optimally employ nuclear weapons in a wide spectrum of nuclear scenarios.

DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) The objective of this project is to quantify nuclear effects on electronics and to provide the technology and other support required to harden and maintain the hardness of electronic systems to these effects. The project was initiated in FY 1980; it was integrated into a single project which includes:

- a. (U) Radiation hardening of electronics (referred to previously as Transient Radiation Effects on Electronics (TREE)),
- b. (U) Electromagnetic pulse (EMP), and
- c. (U) System generated EMP (SGEMP).

2. (U) Although the physical processes which govern these three effects are different in each case, the approach to harden against them is similar. The hardening methodology includes:

- a. (U) Definition and quantification of the effect,
- b. (U) Development of a capability to assess the vulnerability of systems and/or components,

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

c. (U) Development methodologies and technologies necessary to harden and maintain hardness, and

d. (U) Provision of experimental and analytical methods to simulate the effects and verify hardness of systems or components, or both.

3. (U) Many electronic assemblies are susceptible to interrupted operations, degraded performance, or catastrophic failure when subjected to nuclear weapon radiation at levels below those which disturb the physical and structural integrity of a weapon system. The rapid evolution of semiconductor technology has generated new types of devices, new processing techniques, and increased microminiaturization. Advances in each of these areas typically introduce new hardening problems.

4. (U) The electromagnetic pulse (EMP) originates when ionizing radiation from a nuclear burst causes electrons to detach from air molecules. The resulting electron currents in the air radiate high intensity electromagnetic fields which propagate to considerable distances. These fields induce large currents on metallic elements (e.g., cables, antennas, enclosures). These currents can upset and/or permanently damage critical circuits.

5. (U) System generated EMP (SGEMP) is caused by the direct interaction of X-rays with the structure and components of a system. The direct X-ray interaction with the materials of the system creates photoelectrons resulting in the generation of electric and magnetic fields, structural currents, and cable currents. These currents and fields can couple energy into the system causing upset of, or damage to, critical components.

G. RELATED ACTIVITIES: This program supports vulnerability and hardening programs]

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

H. (U) WORK PERFORMED BY: Department of Defense (DoD) agencies, other U.S. Government agencies, civilian contractors, and non-profit organizations.

1. (U) Principal Department of Defense agencies include the Army Harry Diamond Laboratories; Air Force Avionics Laboratory; Air Force Rome Air Development Center; Air Force Weapons Laboratory (AFWL); Naval Research Laboratory (NRL); Naval Surface Weapons Center (NSWC); and Naval Weapons Support Center (NWSC); the Air Force Space Division (AFSD); Air Force Ballistic Missile Office (AFBMO); the Naval Air System Command (NAVAIR); Naval Electronics Systems Command (NELEX); Naval Air Test Center (NATC); Naval Weapons Evaluation Facility (NWEF); and the Naval Ocean Systems Center (NOSC).

2. (U) Other United States Government agencies include Sandia National Laboratories, National Bureau of Standards, the National Aeronautics and Space Administration Jet Propulsion Laboratory, National Security Agency and the Central Intelligence Agency.

3. (U) Contractors include the Aeronutronic-Ford Corp.; Analog Devices, Inc.; ARACOR; BAI, Inc.; Boeing Corp.; Dikewood Corp.; Electro-Magnetic Applications, Inc.; General Electric Co.; Grumman Corp.; GTE Sylvania; Harris Semiconductor; Honeywell, Inc.; Hughes Aircraft Corp.; IBM; IRT Corp.; JAYCOR, Inc.; Kaman Sciences Corp.; Ling-Temco-Vought Corp.; Lockheed Missile and Space Corp.; LUTEC, Inc.; McDonnell Douglas Corp.; Maxwell Laboratories, Inc.; Mission Research Corp.; Motorola, Inc.; National Semiconductor; Northrop Corp.; Physics International Co.; Raytheon Co.; RCA; Rockwell International; Sawyer Research Products, Inc.; Science Applications, Inc.; Simulation Physics, Inc.; Sperry; Systems, Science and Software; Texas Instruments, Inc.; TRW Space & Defense Systems Group, Inc.; and Westinghouse Corp.

4. (U) Educational institutions include Auburn University; the University of California (Lawrence Livermore National Laboratory); Clemson University; University of Illinois; University of Indiana; University of Michigan; Mississippi State University; University of New Mexico; and Yale University.

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

5. (U) Non-profit organizations include the American Society for Testing of Materials (ASTM); IIT Research Institute; Stanford Research Institute; and the Institute of Electrical and Electronic Engineers (IEEE), Inc.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS:

a. (U) Radiation Hardening of Electronics. Major accomplishments in FY 1981 were (1) hardening of two 4K-bit random access memories (RAMs) to meet satellite radiation environments; (2) neutron hardening of a configurable gate array (CGA) which can be used for a wide variety of custom-designed parts; (3) investigation of the radiation sensitivities of advanced processing techniques of potential use by the Department of Defense (DoD) very high speed integrated circuits (VHSIC) program contractors; (4) publication of nine radiation effects standard test methods by the American Society for Testing and Materials (ASTM) and five standard test methods in the Military Standard Procurement System, and (5) testing of a wide variety of integrated circuits for sensitivity to upset by single high energy particles. Additionally, theoretical modeling of the single event phenomena was initiated with the objective of better understanding and enabling the prediction of the effect in future devices.

b. (U) Electromagnetic Pulse (EMP). A technical review process for M-X EMP hardness design features was instituted. Analytical and experimental efforts were conducted to determine the degree of hardness provided by the baseline M-X site design, with particular attention to the Medium Frequency (MF) antenna and power line isolation scheme. Live rocket motor test firings were continued to quantify EMP coupling through motor nozzles to sensitive missile control electronics. A Low Altitude Defense System (LoADS) EMP Vulnerability and Hardening (V&H) program was initiated. EMP interaction estimates and basic hardness engineering guidelines were provided to the Ballistic Missile Defense Center. Evaluation of the application of fiber optics for EMP effects mitigation on military systems was completed. EMP hardening recommendations for the ground-launched cruise missile were developed and briefed to the Under Secretary of Defense for Research and Engineering (USDR&E). EMP environments calculations for the surface fleet were completed.

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

c. (U) System Generated Electromagnetic Pulse (SGEMP). The SGEMP test analysis and research satellite (STARSAT), DNA's full-scale, instrumented model of the Defense Satellite Communications Systems (DSCS-III) satellite, was the subject of a variety of laboratory tests. The objective of these tests was to supplement the data obtained on the HURON KING underground nuclear tests which took place in June of 1981. The M-X Underground Test Working Group was reconstituted to plan a systems-level M-X test in 1985 and two separate phenomenology underground tests in 1982 and 1983. The Nuclear Hardness Evaluation Procedures for Satellites (NHEP-S) were used to evaluate the probability of survival of the Defense Support Program (DSP) satellite in the environment of distant, high-altitude nuclear detonation. Investigations continued to determine the effect of precharging a satellite with electrons on its SGEMP response.

2. (U) FY 1982 PROGRAM:

a. (U) Radiation Hardening of Electronics. Major emphasis of the FY 1982 radiation hardening of electronics program is in five major project areas: (1) hardening of a wide variety of electronic memory and microprocessor devices to nuclear radiation environments; (2) research into the physics of the radiation response in electronic devices; (3) investigation of the recently discovered single event radiation effect phenomena; (4) support of the very high speed integrated circuits (VHSIC) program to provide radiation hardening; and (5) development of hardness assurance procedures for incorporation into the Military Standard Procurement system.

b. (U) Electromagnetic Pulse (EMP). M-X efforts will concentrate on planning and readiness for 1983 system design validation tests. Efforts will include test configuration specification and evaluation, pre-test predictions and participation in test working groups. EMP hardening programs will be initiated for ships and for Army tactical systems. Detailed calculations will be provided for the EMP output of specific United States weapons. Engineering guidelines for the integration of fiber optic links into overall system EMP hardness design will be developed. Research to develop new and improved high-energy electrical surge arrestors suitable for application in land-based, Command, Communications and Control (C³), and strategic systems will be initiated. General guidelines for hardening systems to source region EMP (SREMP) will be developed.

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.d

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

c. System Generated Electromagnetic Pulse (SGEMP). The SGEMP test analysis and research satellite (STARSAT) will be tested in the AURORA facility with components of the single channel transponder subsystem for the Air Force Satellite Communications Program Office in the Air Force Space Division. An M-X cable and connector experiment and a separate M-X SGEMP/source region EMP (SREMP) phenomenology experiment will be fielded on. A pulsed X-ray source will be used to trigger discharges in precharged test samples to determine if such discharges can result in higher currents in satellite electronics than are caused by SGEMP effects alone. The United States Army Harry Diamond Laboratories will continue the investigation of tactical SGEMP effects by adapting an existing simulator or designing a new one to begin testing to evaluate the effectiveness of hardening techniques. A guidebook of recommended SGEMP testing procedures will be published as well as an SGEMP user's manual, a three-volume book for satellite manufacturers on how to incorporate nuclear hardening into satellite design.

d. (U) Source Region EMP (SREMP). Beginning in FY 1982, a new task will be initiated to develop appropriate simulation facilities and test techniques to validate military systems to SREMP effects. This supports M-X, Ballistic Missile Defense Systems, and Army Tactical Systems. This new task will address the definition of the SREMP threat environment, the investigation of candidate pulsed power technologies for transportable SREMP simulators, and, later, the development of a test methodology for SREMP hardness validation.

3. (U) FY 1983 PROGRAM:

a. (U) Radiation Hardening of Electronics. Radiation hardening support of the very high speed integrated circuits (VHSIC) program will continue to be a major effort involving direct interaction with the VHSIC Phase I contractors. The main thrust of the FY 1983 program will involve the radiation evaluation of test chips produced by the VHSIC contractors followed by changes in processing and design parameters to enhance radiation hardness while maintaining commercial production capability. Single event investigations will involve the fabrication of test devices for evaluation of various techniques to reduce upset sensitivities of high density circuits. A review of all published standard test methods and guidelines will be initiated. Hardening of selected devices of high utilization by the DoD will continue.

(U) Project #: X

(U) Program Element #: 6.27.15.H

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Title: Nuclear Effects on Electronics

(U) Title: Defense Nuclear Agency (DNA)

(U) Budget Activity: #1 - Technology Base

b. (U) Electromagnetic Pulse (EMP). The M-X EMP hardness design features will be examined in hardness validation tests. A new Navy technology program will compile a ship EMP response data base, and assist the Navy in developing protection and validation guidelines and tools. A demonstration of tactical environments validation methodology will be performed using the AN/TTC-42 Tri-TAC battlefield switch as a test system. A hardness maintenance and surveillance plan will be developed for ground mobile systems. New design, high-energy, electrical surge arrestors will be fabricated and tested. An addendum will be provided to the DNA EMP Handbook to include source region EMP (SREMP) physics, interaction, protection and hardness validation.

c. The center body of the system generated EMP (SGEMP) test analysis and research satellite (STARSAT) will be irradiated in the underground nuclear test to investigate internal EMP effects and to support the Air Force Space Division hardness validation. Experiments on precharging effects on SGEMP response and on electro-optical sensors for satellite instrumentation will be fielded on Laboratory programs on a variety of SGEMP problems will continue. An SGEMP/SREMP phenomenology experiment in support of M-X will be performed on The test objects will be scale model missiles exposed to simulate a variety of atmospheric pressures.

d. (U) Source Region EMP (SREMP). The AURORA generator will provide a mixed scattered electron-beam and high dose rate gamma-dot capability for SREMP testing of tactical Army systems. Proof-of-principle demonstrations of candidate pulsed power technologies for transportable SREMP testing applications will be provided and an evaluation made.

4. (U) FY 1984 PROGRAM:

a. (U) Radiation Hardening of Electronics. Support of the very high speed integrated circuits (VHSIC) program will continue into Phase II. The investigations into the single event upset phenomena will continue with consideration given to the permanent failure of a single transistor due to the silicon lattice damage caused by a single, high-energy particle.

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

b. (U) Electromagnetic Pulse (EMP). During FY 1984, data from the 1983 M-X design validation tests will be reduced and evaluated. Preparation will begin for full-scale validation tests of M-X scheduled for 1986. General guidelines for hardening ground mobile systems and ships will be formulated. Development of improved tools for simulating tactical EMP environments will begin.

c. System Generated EMP (SGEMP). The SGEMP test analysis and research satellite (STARSAT) will be tested in the underground test. STARSAT will contain upgraded Defense Satellite Communications Systems (DSCS-III) electronics and will be precharged with electrons to determine the effect on SGEMP response. Data from the 1983 M-X SGEMP phenomenology experiment will be used to plan the 1985 M-X systems validation experiment on the underground test.

d. (U) Source Region EMP (SREMP). The Low Altitude Defense System (LOADS) interceptor will be tested in the improved AURORA facility (combination scattered electron-beam and gamma-dot capability) for SREMP effects. The design and construction of a transportable SREMP simulator for testing of both strategic and tactical systems will continue.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Changes in milestones from the last submission are attributable to the following factors: major increase in the Direct Interaction Effects of Electronics in support of the VHSIC initiative; major expansion of SREMP test definition and simulator development to support Army tactical needs; changes in the M-X basing mode and proposed Ballistic Missile Defense Systems.

FY 1982 Develop parts hardened against nuclear radiation effects. Complete M-X missile/SREMP/SGEMP interaction experiments. Perform an M-X cable and connector test and an SGEMP phenomenology experiment on Continue electron precharging experiments by studying X-ray-triggered discharges using an exploding wire X-ray source. Publish the SGEMP Testing Techniques Guide and the satellite manufacturers' hardening practices manual. Initiate the design of a new simulator or the modification of an existing simulator to do testing of SGEMP and SREMP effects on Army tactical communications vehicles.

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: 01 - Technology Base

FY 1983 Continue the development of hardened parts. Support M-X design verification testing (in-place and in-flight). Begin ship simulator development. Complete the source region electromagnetic pulse (SREMP) handbook. Test prototype electrical surge arrestors. Perform a system generated EMP (SGEMP) test analysis and research satellite (STARSAT) center body exposure on the underground test. Perform an SGEMP phenomenology experiment on the underground test. The test object will consist of missile models exposed to various pressures to simulate exposures at different altitudes. Test a tactical Army communications vehicle in an SGEMP simulator. Begin SGEMP testing on AURORA facility. Continue the development of technology for a transportable SREMP simulator. Begin the development of a test methodology for validation of strategic and tactical systems to SREMP effects.

FY 1984 Continue radiation hardening support of very high speed integrated circuits (VHSIC) program. Fabricate an infrared focal plane array charge couple device (CCD) hardened for use at low temperatures. Begin surface fleet EMP testing. Complete ship EMP hardening guidelines. Expose STARSAT with the Defense Satellite Communications System (DSCS-III) electronics and electron precharging on the underground test. Conduct SREMP experiments on the Low Altitude Defense System (LOADS) interceptor in the modified AURORA simulator. Begin the design and construction of a transportable SREMP simulator.

		(\$ in Thousands)			
	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COST TO COMPLETION</u>
7. (U) <u>RESOURCES:</u> Nuclear Effects on Electronics	13,458	20,300	23,300	29,200	Continuing

a. (U) BASIS FOR FY 1983 REQUEST: The FY 1983 request will support hardening of electronic components and systems to direct radiation effects, EMP, SGEMP, and SREMP. Approximately one-half of the total funding will support the direct radiation effects program with the remainder equally divided among the three other areas.

(U) Project #: X

(U) Title: Nuclear Effects on Electronics

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1982: The increase in funding in FY 1983, vice FY 1982, will be utilized to support the Department of Defense Very High Speed Integrated Circuit (VHSIC) initiative to provide hardened, high-density microelectronics parts for strategic, space and tactical systems.

DEFENSE NUCLEAR AGENCY
FY 1983 PDT&E DESCRIPTIVE SUMMARY

(U) Project #: Y (U) Title: Strategic Structures Vulnerability and Hardening
(U) Program Element #: 6.27.15.H (U) Title: Defense Nuclear Agency (DNA)
(U) DoD Mission Area: #54C - Defense Nuclear Agency (U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) Vulnerability and hardening issues related to land and sea based strategic systems such as M-X basing, secure reserve basing, advanced submarines, basing for cruise missiles and ballistic missile defense systems require an enhanced understanding of cratering, ejecta, airblast, ground shock, and at-sea environments resulting from nuclear detonations.

2. (U) In the absence of atmospheric nuclear tests, information on nuclear weapons effects and their interaction with hardened structures will continue to be derived from theory, calculations, scaled laboratory experiments, high explosive tests, underground nuclear tests and assessments of data gathered on previous atmospheric nuclear detonations. Improved understanding of nuclear cratering and blast pressure, become more important because of continually improving accuracies in weapon delivery systems, increasing numbers of weapons with widely varying yields, and the growing diversity in targets of interest. Specific subjects being pursued include: the prediction of crater size; dynamic airblast; ejecta size and distribution; shock propagation through the ocean; the interaction of these effects with hardened structures; and the resulting structural behavior and internal equipment response.

3. (U) RELATED ACTIVITIES: Service and other agency requirements for nuclear weapons effects information support systems such as: M-X; MINUTEMAN; naval vessels; ballistic missile defense and tactical nuclear weapons systems; and the understanding of similar foreign systems.

H. (U) WORK PERFORMED BY: Department of Defense laboratories, civilian contractors, educational institutions, and nonprofit organizations.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

1. (U) Principal Department of Defense laboratories include: Army Ballistic Research Laboratory; Army Engineer Waterways Experiment Station; the Navy Civil Engineering Laboratory; Air Force Weapons Laboratory; Naval Research Laboratory; Naval Surface Weapons Center, and the David W. Taylor Naval Ship P&E Center.

2. (U) Other government laboratories include: Los Alamos National Laboratory and Lawrence Livermore National Laboratory.

3. (U) Principal contractors include: Science Applications, Inc.; Physics International Co.; TPW Defense and Space Systems Group; Weidlinger Associates; Systems, Science and Software, Inc.; Terra Tek, Inc.; California Research and Technology; Sandia Laboratories; Lockheed Missiles and Space Co.; J. H. Wiggins Co.; the Boeing Co.; and Merritt CASES, Inc.

4. (U) Educational institutions and nonprofit organizations include: the California Institute of Technology; the University of California; the University of New Mexico; Rand Corp.; SRI International; and Southwest Research Institute.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS:

a. (U) Major support was provided to the Air Force on nuclear hardness and survivability (NH&S) aspects of the M-X weapon system full scale engineering development. The primary emphasis was on the definition of nuclear weapons effects design environments that envelope plausible single and multiburst attack options; the acquisition of system hardening data for evolving a cost effective design; and the development of simulation and test techniques for system level validation.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

b. (U) A joint program with the Army's Ballistic Missile Defense System Command (BMDS) was initiated to support the nuclear weapons effects environment definition for the ballistic missile defense (BMD) system.

c. (U) Efforts were completed to quantify and reduce uncertainties in target specification and vulnerability assessment methods. Blast tests of models of foreign hard targets, including missile silos and shallow buried structures were completed. Planning for combined airblast and crater related effects tests on hard targets was initiated.

d. (U) Work has been directed at applying and extending existing water shock, water wave, and submerged structures technologies to both increase the survivability of submarines and to understand their vulnerability to nuclear weapons effects. Shock loading prediction methods developed for submarines were applied to the surface ship response problem in conjunction with the joint DNA-Navy underwater shock test of the USS ARKANSAS (CGN-41). The water shock and wave environments produced by nuclear explosions in shallow water were defined for application to vulnerability estimates of ships and submarines in port.

e. (U) Structure media interaction computer codes were used in concert with test results to increase understanding of structural response, and to improve design procedures for facilities such as missile silos, command and control centers, and submarines. Related computational efforts included improving the understanding of cratering, blast and shock effects from nuclear weapons.

f. (U) Simulation of nuclear airblast with fuel air explosives was attempted at a scale large enough to determine yield scaling relationships. A simulation technique was developed for conducting underwater nuclear effects experiments against submarine models. Efforts are underway to investigate new applications of existing simulation techniques to satisfy requirements of nuclear weapons effects on M-X basing systems.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: C.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

g. (U) Nearing completion of the "benchmark" cratering calculation and interpretation of the revised empirical data base should result in a better understanding of the uncertainty in cratering predictions. Calculations to increase understanding of height-of-burst and geologic effects on cratering and related ground motions will be accomplished. Planning for a delicate underground nuclear test (MISTY JADE) to verify the improved calculational techniques will begin.

h. Planning was conducted and an experiment was completed to investigate acoustic reverberation.

2. (U) FY 1982 PROGRAM:

a. (U) This project will provide nuclear weapon effects (NWE) criteria to support the near-term solution of using existing missile silos for the M-X missile as well as providing the NWE environment and the nuclear hardening and survivability (NH&S) criteria for developing and evaluating the long-term M-X deep underground basing option. The state-of-the-art of tunneling technology will be assessed in evaluating the constructability/survivability/hardenability of the deep basing concepts. Planning will commence for a post-attack egress demonstration of a deeply buried facility.

b. Experimental and analytical methods will be used to improve hardness assessment techniques for analyzing. This work will reduce uncertainties in target specification and vulnerability assessment techniques.

c. Participation will continue in the testing program conducted by the British Navy utilizing models of nuclear powered submarines. Greater emphasis will be placed on upgrading and validating existing analytical tools and in understanding the behavior of structural materials, damage mechanisms in structural assemblies. The submarine program will also utilize the results of an accelerated naval surface ship vulnerability study.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #54C - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

1. A combined theoretical and experimental program will be designed to evaluate new prediction techniques for explosively induced ground motions. Experiments will be designed to provide data on dust sweep-up and lofting mechanisms for evaluation of Cratering calculations to refine and verify the improved predictive techniques will continue. Emphasis will be placed on obtaining additional experimental data.

e. (U) Data from the nuclear weapon effects (NWE) simulation development tests will be evaluated and the most promising techniques will be further developed and evaluated for large-scale structural testing application/validation of candidate basing options.

f. (U) Support of the nuclear environment definition for ballistic missile defense system structures is planned.

3. (U) FY 1983 PLANNED PROGRAM:

a. (U) New and modified M-X near surface shelter systems for quick response will be developed and evaluated. Nuclear weapons effects environment and design criteria for near surface missile basing and deep underground basing will be developed. Planning will commence for deep underground structures validation, and for validation of the candidate sites for the system. A full scale simulation technique for post-attack egress system validation for deep basing system concepts will be developed and designed.

b. Participation in the British Navy's testing of submarines will be concluded. Verification of submarine model damage in a deep depth simulator will be conducted. A small scale fuel air explosive simulator will be developed and field tests conducted.

A long range acoustic reverberation (BLUEOUT) experiment will be conducted in the to evaluate the global effects of nuclear weapons on naval strategic systems.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

c. Structural loading data will be collected on a variety of targets and applied to vulnerability assessments of hard target structures. An upstream airblast simulator will be developed. Tests and analysis of buried arches will be completed. The physical survivability of through-the-earth communications capabilities will be evaluated.

d. (U) Cratering phenomenology calculations will be completed and compared to the data from the Enewetak Atoll Seismic Investigation (Project EASI).

e. (U) Dynamic measurements in structural backfill of airblast-induced ground shock for close-in structure vulnerability/survivability evaluation will begin and will be correlated with static laboratory data. An analytical method for comparing analytical waveforms will be developed along with controlled strain path laboratory testing equipment.

f. (U) An improved dust flow and thermal layer model will be developed. A height-of-burst (HOB) experiment will be designed for the high explosive event DIRECT COURSE.

g. (U) Support of the nuclear environment definition for ballistic missile defense system structure is planned.

4. (U) FY 1984 PLANNED PROGRAM:

a. (U) Follow-on cratering calculations will continue and will provide support for the MESTY JADE test design.

b. (U) Experiments to determine the horizontal stress in structure backfill and the simulation development for an airblast-induced horizontal motion concept will be completed.

c. Data from the BLUEOUT experiment will be used to calibrate the existing predictive model. Verification of underwater explosion-induced bubble loading, shadow and convergence zones will commence.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

d. A vulnerability test to combined airblast and crater related effects will be conducted. A deep underground facility subsystem and system-level testing at prototype-like scale will be conducted.

e. (U) A high thermal flux soil blow-off experiment will be conducted. A nonideal airblast simulator program will begin.

f. (U) Deep underground basing survivability at depth, egress techniques, endurance concepts, communication responsiveness and site identification will be evaluated.

g. (U) Programs will continue to provide improved understanding of cratering, airblast and ground shock effects.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: There is no significant change in project milestones from January 1981 submission.

FY 1982 a. (U) Initiate development of height-of-burst simulation techniques.

b. (U) Develop programs to provide design data for new and modified existing ICBM silos. Siting, cratering and the nuclear environment for deep underground basing will be defined.

c. (U) Conduct failure level tests of model bridges, dams and urban industrial buildings.

d. (U) Develop laboratory and in-situ techniques to evaluate ground motion.

e. (U) Utilize generic source calculations and reevaluation of experimental data to resolve differences between theoretical and empirical cratering predictions and plan an underground test (UGT) for verification.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Product Activity: #1 - Technology Base

- f. Begin planning for acoustic reverberation experiments. ☒
- g. (U) Support environment definition for ballistic missile defense system.
- h. (U) Develop technique to simulate height-of-burst flow fields at large-scale.
- FY 1983 a. (U) Evaluation of the M-X missile near surface and deep underground basing options.
- b. Participation in British Navy's testing of ☒ submarines concluded.
- c. Conduct vulnerability tests. ☒
- d. (U) Revise cratering prediction techniques and planning for underground test (UGT) verification.
- e. Conduct acoustic reverberation experiments. ☒
- f. (U) Support environment definition and resulting loads on ballistic missile defense structures.
- g. (U) Design height-of-burst (HOB) experiment for the high explosive event DIRECT COUPSE.

FY 1984
concept.

- a. (U) Support and evaluate the design, validation, planning and testing of the deep underground basing concept.
- b. (U) Program to verify underwater explosion-induced bubble loading and shadow convergence zones begins.

(U) Project #: Y

(U) Title: Strategic Structures Vulnerability and Hardening

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

- c. near surface hardened basing system vulnerability test will be conducted.
- d. (U) Deep underground facility subsystem and system-level testing at prototype-like scale will commence.
- e. (U) Continue definition of nuclear environment on ballistic missile defense structures.

		(\$ in Thousands)			
	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COST TO COMPLETION</u>
7. (U) RESOURCES: Strategic Structures Vulnerability and Hardening	10,598	21,300	21,300	21,100	Continuing

a. BASIS FOR FY 1983 REQUEST: The FY 1983 request will support efforts to improve the understanding of critical nuclear weapon effects in the following areas: hardening technology of near surface hardened missile basing systems; assessing deep underground basing concepts; structural behavior of ballistic missile defense systems; target vulnerability associated and shallow buried structures; hardening technology assessment uncertainties associated with damage mechanisms, component versus system properties and ground shock; nuclear environment simulation techniques; at-sea and below surface detonations, and advanced submarine ship structures response.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1982: The funding decrease is due to in part to a one time \$2M Pacific Proving Grounds drilling effort in FY 1982 and to programmatic adjustments in overall priorities.

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DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: G

(U) Title: Effects Simulation Using Radiation Simulators

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to obtain nuclear weapons effects data by testing strategic and tactical weapons systems and their major components in simulation facilities. These effects include high-altitude electromagnetic pulse (EMP), system generated EMP (SGEMP), dispersed EMP (DEMP), transient radiation effects on electronics (TREE), and thermomechanical shock. These simulations provide information for vulnerability assessments and nuclear hardness validations for a fraction of the cost of underground nuclear testing. Further, portable simulators can provide quality results at operating locations in the field.

(U) RELATED ACTIVITIES: This program supports service requirements for nuclear weapons effects data to evaluate the nuclear survivability and hardness of strategic, tactical and command, control, and communications (C³) systems.

(U) WORK PERFORMED BY: Department of Defense (DoD) agencies, other United States Government agencies, civilian contractors, educational institutions and a non-profit organization.

1. (U) Principal DoD agencies include Field Command, Defense Nuclear Agency; Defense Communications Agency; United States Army Ballistic Research Laboratory; United States Army Harry Diamond Laboratories; United States Army Engineer Waterways Experiment Station; United States Army Natick Laboratories; United States Army Ballistic Missile Office; Headquarters, United States Air Force; Headquarters, Strategic Air Command; Air Force Logistics Command; Air Force Space Division; Air Force Weapons Laboratory; Naval Research Laboratory; Naval Surface Weapons Center; Navy Strategic Systems Project Office; Naval Air Systems Command; and Naval Electronics Command.

(U) Project #: G

(U) Title: Effects Simulation Using Radiation Simulators

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

2. (U) Other United States Government agencies include the Federal Emergency Management Agency.

3. (U) Contractors include Advanced Research and Applications Corp.; Aeroneutronic-Ford Corp.; The BDM Corp.; BENDIX Field Engineering; Boeing Aerospace Co.; EG&G; Electro-Magnetic Applications, Inc.; General Electric Co.; Grumman Aerospace Corp.; Honeywell Corp.; IRT Corp.; JAYCOR; Kaman Sciences Corp.; Los Alamos Technical Associates; LUTEC; McDonnell Douglas Corp.; Maxwell Laboratories, Inc.; Mission Research Corp.; Nichols Research; Norman Engineering Co.; ORI; Physics International Co.; Pulsar Associates, Inc.; SANDIA Corp.; Science Applications, Inc.; Simulation Physics, Inc.; Systems, Science and Software; TRW Space & Defense Systems Group; Pulse Sciences, Inc.; and Vought Corp.

4. (U) Educational institutions include University of California and University of Dayton.

5. (U) The non-profit organization is Stanford Research Institute International.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS:

a. (U) The advanced research electromagnetic simulator (ARES) develops a threat-level, electromagnetic pulse (EMP) environment for testing a variety of Department of Defense (DoD) weapons systems. These include small to medium-sized aircraft, tactical and strategic missiles, and satellites. All major missile systems, such as MINUTEMAN, POSEIDON, and TRIDENT, have been successfully tested in prior years at the ARES facility. An upgrade of the facility instrumentation system was initiated in FY 1981 to prepare for upcoming M-X missile EMP testing, scheduled for January-July 1983.

b. The AURORA gamma ray facility produces a ionizing radiation environment over an approximate one cubic meter volume and lesser intensity over larger volumes. This permits the testing of complete electronic subsystems. Major users in

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(U) Project #: G

(U) Title: Effects Simulation Using Radiation Simulators

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

FY 1981 included the Air Force Ballistic Missile Office (M-X Guidance System Electronics), Naval Research Laboratory (ion beam production experiments), United States Army Harry Diamond Laboratories (source region electromagnetic pulse investigations), and the United States Army Ballistic Missile Division (X-ray laser).

c. The CASINO flash X-ray facility produces a X-ray output which is capable of producing thermochemical shock on critical electronic components and inertial guidance systems. Major system tests conducted at CASINO in FY 1981 include TRIDENT (terminal fix sensor components), M-X (plated wire memories, cables, and reentry vehicle antenna material characterization), and the Navy Standard Missile (SM-1).

d. (U) The research, development, test and evaluation (RDT&E) activities in support of the Satellite X-ray Test Facility (SXTF), first begun in FY 1977, have been terminated at the direction of the Under Secretary of Defense for Research and Engineering (USDRE).

e. (U) The DNA Aircraft Electromagnetic Pulse (EMP) Program is developing an Assessment Methodology/Technology. In FY 1981, threat-level EMP testing of the first test bed aircraft (A-7E) was completed. A preliminary assessment of the FB-111A aircraft consisting of analytical evaluation, direct drive current injection testing (black boxes) and Skin Current Injection Technique (SCIT) testing of the entire aircraft was completed. Testing of a second test bed aircraft (F-14A), was started in FY 1981.

f. (U) The prototype continuous wave radiated test system was used in the EMP assessment of three Hawaiian telecommunications facilities as a follow-on to Project APACHE (assessment of Pacific communications for hardening to EMP). Subsequent applications of the continuous wave radiation system have been identified to support other experimental programs in the Pacific.

g. (U) The thermal radiation effects simulation (TRS) thermochemical source development was completed in 1981. This source was used on the MILL RACE high explosive test of the Army's Hardened Shelter, the Navy's model deckhouse and antennas, and a variety

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(U) Title: Effects Simulation Using Radiation Simulators

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(U) Budget Activity: #1 - Technology Base

of equipment from the United Kingdom. A "3-lamp" flash lamp prototype was completed and demonstrated in 1981.

2. (U) FY 1982 PROGRAM:

a. (U) In FY 1982, the advanced research electromagnetic simulator (ARES) instrumentation system upgrade will be completed. FY 1982 operation and maintenance activities will include refurbishing the electromagnetic pulse (EMP) pulser and waveguide, installing a new video monitor system, and other tasks necessary to prepare the facility for the M-X missile test beginning in January 1983.

b. (U) The major users of the AURORA facility will be the Ballistic Missile Office (M-X), the Air Force Space Division (DSCS III (Defense Satellite Communications System) single-channel transponder), the Army (XM-2 Infantry Vehicle), the United States Army Harry Diamond Laboratories (source region EMP experiments), and the Naval Research Laboratory (ion beam production, transport, and focusing). The DNA STARSAT (system generated EMP test, analysis and research satellite) model of the DSCS III communications satellite will be tested to supplement the power subsystem data obtained on the HURON KING underground nuclear test.

c. (U) The CASINO facility will continue to provide user support to test electronic components, inertial guidance and plated wire memory subsets for both M-X and TRIDENT. Other Navy tactical systems, such as Standard Missile-2 (SM-2), will also utilize the CASINO facility. Efforts to increase the dose-area product to meet upcoming user requirements for system-level testing will also be continued.

d. (U) Full-system-level EMP testing of the F-14A aircraft in the horizontal polarized dipole (HPD) simulator supplemented by direct-drive current injection will be completed. The refined assessment methodology will be applied to the FB-111A in FY 1982/1983. The joint technology program will address issues associated with strategic aircraft hardening and develop plans for a test bed demonstration hardening program.

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e. (U) The thermal radiation effects simulation (TRS) liquid oxygen (LOX) source will be returned to the TRS facility at Kirtland Air Force Base, where it will be used to expose various materials and equipment of the three Services and other government agencies as requirements are presented. The Phase IB Flash Lamp will be completed and used for DNA soil blow-off experiments and to test the Army Ballistic Missile Defense (BMD) radar materials. Phase II Flash Lamp development will commence.

f. (U) Planning for a radiation research facility will be completed. This facility will provide a capability to do research on radiation effects on satellite and missile components. It will make maximum use of existing facilities. An existing DNA radiation simulator will be modified by adding a vacuum tank or an existing vacuum tank will be modified by adding radiation sources. Acquisition of hardware will begin.

3. (U) FY 1983 PROGRAM:

a. (U) Final integration and operational checkout of the advanced research electromagnetic simulator (ARES) upgraded instrumentation system will be completed in the first quarter of FY 1983. The M-X missile is scheduled to arrive on-site November 1982, and the M-X missile test will be conducted from January-July 1983.

b. (U) The major users of the AURORA facility will be the Air Force Ballistic Missile Office (M-X), the Naval Research Laboratory (ion beam production, transport, and focusing), and the United States Army Harry Diamond Laboratories (tactical system generated electromagnetic pulse experiments). AURORA will be modified to produce ion and electron beams for thermomechanical shock users.

c. (U) The CASINO facility will be used by M-X and TRIDENT for thermomechanical effects testing of magnetic memory and inertial guidance subsets.

d. (U) Full-system-level electromagnetic pulse (EMP) testing of the FB-111A will be completed. Comparison of skin current

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(U) Title: Effects Simulation Using Radiation Simulators

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(U) Budget Activity: #1 - Technology Base

Injection technique (SCIT), large-scale model, and horizontal polarized dipole (HPD) test results of the F-14 and F-111A will be completed. Assessment methodology verification will be accomplished by testing the F/A-18. The F/A-18 will also undergo SCIT and direct-drive testing, as well as a large-scale model measurement program in FY 1983.

e. (U) The thermal radiation effects simulation (TRS) liquid oxygen (LOX) source facility will also be used on DIRECT COURSE, a high explosive event, in September 1983. Work on Phase II Flash Lamp development will continue.

f. (U) The acquisition of hardware (vacuum tank and/or radiation sources) for the Radiation Research Facility will continue. Additional instrumentation will also be acquired.

4. (U) FY 1984 PLANNED PROGRAM:

a. (U) The major users of the AURORA facility will be the Naval Research Laboratory (pellet implosion experiments with ion beams) and the Harry Diamond Laboratories (tactical system generated electromagnetic pulse and source region electromagnetic pulse experiments). The electron/ion beam modification will be used for thermomechanical shock testing of M-X components.

b. (U) Major system users at CASINO are anticipated to be M-X and TRIDENT II for thermomechanical effects testing of inertial guidance subsets. Work will continue on the upgrade of CASINO.

c. (U) The aircraft electromagnetic pulse (EMP) assessment methodology will be completed and documented for all Department of Defense (DoD) users. Skin current injection technique (SCIT), as an alternate means of simulation for assessment/methodology, hardness maintenance/surveillance and fleet verification, will be finalized. The joint technology program will continue to address issues associated with hardening strategic systems.

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(U) Title: Effects Simulation Using Radiation Simulators

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(U) Title: Defense Nuclear Agency (DNA)

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(U) Budget Activity: #1 - Technology Base

d. (U) The thermal radiation effects simulation (TRS) facility will continue to operate. Work on Phase III Flash Lamp development will commence.

e. (U) The acquisition of hardware and instrumentation for the radiation research facility will be completed. The facility will be operated in support of research objectives in the DNA system generated electromagnetic pulse (SCEMP) and transient radiation effects on electronics (TREE) programs.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Changes in milestones from the January 1981 submission are attributable to the following factors:

a. (U) The continuing redefinition and revision of priorities of service test requirements for weapons systems, e.g., M-X, FB-111, F/A-18, and POLARIS C4, etc., and the evolving need to simulate new threat environments, e.g., field TRS, cause milestone changes.

b. (U) The cancellation of the Satellite X-ray Test Facility (SXTF) program in July 1981.

FY 1982 (U) Complete procurement and integration of the advanced research electromagnetic simulator (ARES) instrumentation system. Operate the AURORA and CASINO facilities in the ionization testing mode for the Air Force Space Division, Air Force Ballistic Missile Office, Army Ballistic Missile Defense Center, Army Harry Diamond Laboratories, and the Navy TRIDENT II program. Complete the F-14A full-system-level test in the horizontal polarized dipole (HPD). Complete large-scale model measurements of the F-14A and FB-111. Start large-scale model measurement program for the F/A-18. Start full-system-level test of the FB-111A in the horizontal polarized dipole (HPD) and/or TRESTLE simulator. Refine assessment methodology. Phase IB Flash Lamp TRS will be completed in March 1982.

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FY 1983 Receive M-X missile for the ARES T-21 test. Perform final acceptance checkout of instrumentation system. Conduct extensive six-month electromagnetic pulse (EMP) test in ARES.

Operate the AURORA and CASINO facilities in the ionization and particle beam thermomechanical shock testing modes for the Air Force Space Division, Air Force Ballistic Missile Office, Army Ballistic Missile Defense Center, and Army Harry Diamond Laboratories. Upgrade the AURORA instrumentation by providing new transient digitizers and tape recorders. Complete the FB-111A full-system-level testing on the vertical polarized dipole (VPD). Perform skin current injection technique (SCIT), direct-drive and large-scale model measurement tests of the F/A-18. Start full-system-level test of the F/A-18. TRS liquid oxygen (LOX) will be fielded on DIRECT COURSE in September 1983. Begin acquisition of hardware for a radiation research facility.

FY 1984 (U) Operate ARES, AURORA, and CASINO in support of Service program users. Complete F/A-18 full-system-level test on HPD. Complete acquisition of hardware for a radiation research facility.

	(\$ in Thousands)				COST TO
	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COMPLETION</u>
7. (U) <u>RESOURCES</u> : Effects Simulation Using Radiation Simulators	19,391	19,500	31,700	36,900	Continuing

a. (U) BASIS FOR FY 1983 REQUEST: These funds will be used in two ways. The first is the operation of existing simulators for nuclear weapons effects testing. The second is the development of the Radiation Research Facility.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1982: The increase in funding in FY 1983 is primarily because the peak of the hardware acquisition for the Radiation Research Facility will occur in this fiscal year.

DEFENSE NUCLEAR AGENCY
FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: H

(U) Title: Effects Simulation Using High Explosives

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) The objective of the effects simulation using high explosives project is to obtain nuclear weapons effects data through the use of large-scale high explosive field tests. This project provides information which either cannot be obtained from underground nuclear tests or which would be more costly to obtain in that manner. High explosives can be used effectively to simulate certain aspects of nuclear phenomenology including airblast, ground and water shock, water waves, craters, ejecta, some aspects of dust clouds, and multiburst interaction effects.

2. (U) High explosive simulations provide data necessary for evaluating the hardness of existing systems (both United States and foreign) and for the development of advanced design techniques for future systems such as the M-X system.

3. (U) RELATED ACTIVITIES: This program supports Service requirements for nuclear weapons effects data necessary for both hardening and utilization of a number of strategic and tactical weapons systems and support systems.

4. (U) WORK PERFORMED BY: Department of Defense (DoD) agencies, other United States Government agencies, civilian contractors, educational institutions, and nonprofit organizations.

1. (U) Principal Department of Defense Agencies include Naval Sea Systems Command; Office of Naval Research, Naval Surface Weapons Center, Air Force Weapons Laboratory, Air Force Space Division, Army Ballistic Research Laboratories, U.S. Army Engineer Waterways Experiment Station, David W. Taylor Naval Ship R&D Center, and Army White Sands Missile Range.

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(U) Title: Effects Simulation Using High Explosives

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2. (U) Contractors include Agabian Associates, Boeing Aerospace Co., the BDM Co., EG&G Inc., Physics International Co., Lockheed Missiles and Space Co., Systems, Science & Software, Inc., Kaman Sciences Corp., Pan American World Airways, Prototype Development Associates, Science Applications Inc., TRW Systems, Inc., and Terra Tek, Inc.

3. (U) Educational institutions include University of California, Los Alamos National Laboratory/Lawrence Livermore National Laboratory.

4. (U) Nonprofit organizations include SRI International and ITT Research Institute.

1. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: Since the early sixties, DNA has maintained a large yield high explosives (HE) test program that has provided the Services with a HE-generated, 1 kiloton (KT) nuclear airblast equivalence series of tests. Through the years, prior to FY 1981, various experiments have been conducted for many major systems, among which have been MINUTEMAN, SANGUINE, M-X and SAFEGUARD. Army tactical vulnerability experiments have been fielded, as have experiments for agencies such as the Federal Emergency Management Agency (FEMA), the Defense Communications Agency (DCA) and the Defense Intelligence Agency (DIA). In FY 1978, two large yield HE experiments called MISERS BLUFF were conducted in direct support of the These tests were conducted to evaluate the influence of multiburst effects on siting and vulnerability. Additionally, a number of related experiments were fielded including experiments by four North Atlantic Treaty Organization (NATO) countries. In September 1981, MILL RACE, the first major HE test in the MISTY CASTLE series, took place. This test was an HE simulation of a 1 KT nuclear airblast and supported requirements from all three services, FEMA, and two allied countries. In FY 1979 and FY 1980, HYBRID GUST, a series of small-scale experiments, were conducted as part of the DIRECT AIM test series. These experiments defined the free field airblast and ground motion environments associated with multiburst attacks against the concept. The 1981 HYBRID GUST effort included the design and development of large-scale blast and shock simulators capable of replicating the nuclear threat environment for both single and multibursts. They were used for system level design and hardness validation testing of shelter components. As part of the DIAMOND MILL series, test plans were prepared to investigate submarine hull response of a nuclear ballistic missile submarine model to underwater shock.

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2. FY 1982 PROGRAM: Final reporting will be accomplished for the MILL RACE event and planning initiated for the 1983 DIRECT COURSE high explosive (HE) event. In the DIAMOND MILL series underwater shock testing will be accomplished in the deep depth underwater simulation device. Large-scale double hull submarine model fabrication and planning for a surf zone simulation test will continue. DIRECT AIM experiments on external protection systems will continue.

3. FY 1983 PLANNED PROGRAM: Field construction for DIRECT COURSE (second large scale HE event in the MISTY CASTLE series) will be accomplished during February-August 1983. The event will take place in September 1983. The DIAMOND MILL test series will continue with underwater explosive tests of large-scale double hull submarine models. Planning will continue for a surf zone simulation test. The DIRECT AIM series will continue with simulation testing of concepts.

4. FY 1984 PLANNED PROGRAM: Final reporting will be accomplished for the DIRECT COURSE event and planning initiation for the 1985 MINOR SCALE HE event. The DIAMOND MILL test series will continue with a combined surf zone and model ship and submarine shock test. Blast and shock simulator conceptual designs for testing to validate concepts will be provided to the U.S. Air Force.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES:

FY 1982 a. (U) DIRECT COURSE - Initiate field efforts September 1982.

b. DIRECT AIM - As part of the DIRECT AIM series simulation techniques for [] tests will be developed to evaluate alternative basing modes.

c. (U) DIAMOND MILL - Conduct intermediate scale submarine hull model tests in the pressurized cylinder depth simulation device.

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FY 1983 a. (U) DIRECT COURSE - Field construction April-August 1983. Detonate in September 1983.

b. (U) DIRECT AIM - Final, full scale preproduction, test simulator development will be completed as part of DIRECT AIM.

c. (U) DIAMOND MILL - Participation in underwater explosive tests of large scale double hull submarines.

FY 1984 a. (U) MINOR SCALE - Institute field efforts September 1984.

b. (U) DIRECT AIM - Height-of-burst simulation techniques will be developed as part of DIRECT AIM.

c. (U) DIAMOND MILL - Participate in the combined surf zone and ship/submarine shock test.

7. <u>RESOURCES:</u>	<u>Effects Simulation Using High Explosives</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>
		10,056	6,300	9,900	7,200
					Continuing

a. (U) BASIS FOR FY 1983 REQUEST: The FY 1983 request will support requirements from all services with a large-scale high explosive (HE) test. The Navy will be provided submarine vulnerability data in addition to a verification of present dynamic design procedures with respect to shock hardening. The FY 1983 request will also provide for a scaled M-X structure test.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1982: The funding increase is due to a major high explosive test being conducted in FY 1983.

DEFENSE NUCLEAR AGENCY
FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: I (U) Title: Effects Simulation Using Natural Disturbances
(U) Program Element #: 6.27.15.H (U) Title: Defense Nuclear Agency (DNA)
(U) DoD Mission Area: #540 - Defense Nuclear Agency (U) Budget Activity: #1 - Technology Base

F. (U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) The objective is to use natural and artificial phenomena as aurora and metal releases in the atmosphere as well as laboratory experiments to simulate important aspects of atmospheric conditions following nuclear detonations. The understanding gained of the plasma, infrared (IR) and other processes is applied to our models of nuclear weapons effects for system design and mitigation in High Altitude Phenomenology and Applications, Project S. In the absence of atmospheric nuclear testing, this approach is an important source of critical data.

2. (U) The objective is accomplished through a series of atmospheric experiments. Naturally occurring aurora and magnetic substorms are probed with satellite, space shuttle, rocket and ground based instrumentation to discern the IR chemistry processes and the effects on propagation of radio signals through the ionosphere. Barium releases permit insight into the processes which create discontinuities or structure in the plasma created by an exoatmospheric nuclear detonation. This structure is deleterious to radio signal transmissions. A planned Uranium release into near space will permit the measurement of the spectra and brightness of its long wave IR emissions. Such emissions from weapon debris are predicted to create a severe environment for numerous weapons systems. Similarly, high explosive tests lend insight into the propagation of radar signals through dust clouds lofted by surface or near surface nuclear detonations.

G. (U) RELATED ACTIVITIES: This program supports service requirements for nuclear weapons effects data for application to a number of strategic weapons, communications, surveillance, and support systems:

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(U) Title: Effects Simulation Using Natural Disturbances

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(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

1. (U) Systems whose communications performance in a nuclear environment have been evaluated using these data include TRIDENT, Advanced Airborne Command Post (AABNCP), Air Force Satellite Communications System (AFSAT), Global Positioning System (GPS), and the Defense Support Program (DSP), the Defense Satellite Communications System (DSCS) and candidate adaptive high frequency (AHF) system.

2. The [in nuclear scenarios is assessed using infrared (IR) predictions based upon these data. The new design will be tested against such predictions as well. The nuclear mission capability of space defense and ballistic missile defense concepts and design are assessed with predictions extrapolated from natural long wavelength infrared (LWIR) data acquired.

1. (U) WORK PERFORMED BY: Department of Defense (DoD) agencies, civilian contractors, educational institutions, and nonprofit organizations.

1. (U) Principal DoD agencies include Air Force Geophysics Laboratory and the Naval Research Laboratory.

2. (U) Contractors include ESL, Inc.; Technology International Corp.; Lockheed Missiles and Space Corp.; Mission Research Corp.; Photometrics; Science Applications, Inc.; Information Science Inc.; Physical Dynamics Inc.; and SANDIA Laboratory.

3. (U) Educational institutions and nonprofit organizations include University of Alaska; Utah State University; University of California (Los Alamos National Laboratory); and SRI International.

1. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

(U) Project #: I

(U) Title: Effects Simulation Using Natural Disturbances

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS:

a. (U) Laboratory and theoretical efforts, continue to identify the radiation sources which produce the infrared (IR) emissions seen in rocketborne measurements of ambient i.e., nonauroral earth limb, and auroral radiances.

b. The FY 1980 flight of the Rocketborne Electron Accelerator (EXCEDE) experiment produced energy deposition levels which are orders of magnitude greater than those of natural aurora.

The stimulated IR emissions were intense and measured by ground based as well as rocket and airborne instrumentation. The data will permit the identification, understanding, and extrapolation to the nuclear case of the chemistry and photo efficiency of the IR emissions. Modeling of nuclear induced emissions is necessary to determine their impact upon the as well as the missions of space defense and ballistic missile defense (BMD) systems under development or consideration.

c. (U) The DNA Wideband Satellite experiment was launched into a near polar, sun synchronous orbit in May 1976. The predicted life expectancy was one year, but successful system operation continued until August 1979. Data were obtained on the distortion effects (scintillation) on electromagnetic signal propagation at very high frequency (VHF) and super high frequency (SHF). As a part of this program, a series of experiments were designed to provide information necessary to verify the model of the atmospheric phenomena that cause scintillation. During FY 1978 and FY 1979 simultaneous rocket, radar and satellite measurements made in both auroral and equatorial regions successfully determined the structure of naturally occurring striations, which form by mechanisms that can be related to the nuclear case. Comparisons of data and theory have been completed and have resulted in a mechanism that can be related to the nuclear case. Comparisons of data and theory have been completed and have resulted in a substantial improvement in our understanding of the physical mechanisms which cause the striations.

d. (U) High altitude barium releases create striations similar to nuclear environments. Such active simulation have been used successfully to assess communications links. The Satellite Transmission Effects Simulations (STRESS) experiment, a joint DNA/United States Air Force project, measured the performance of the Lincoln Experiment Satellite 8 and 9 and the Air Force Satellite

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Communications System (AF SATCOM) airborne electronic processors in March 1977. The Ave Fria experiment in 1978 used a shaped charge barium release to precisely locate the striations between two synchronous orbiting satellites, ATS-3 and ATS-6, and their respective ground stations. Spread spectrum such as used in antijam and navigation systems were tested in the Position Location and Communications Effects Simulation (PLACES) experiment fielded in December 1980.

e. (U) The understanding of the instabilities and physics which lead to striation formation and signal scintillation in ionospheric irregularities and in barium clouds has been codified in theoretical predictions of nuclear environments and integrated into a simulator for assessing communications link performance.

2. (U) FY 1982 PROGRAM:

a. The joint DNA/United States Air Force Earthlimb Auroral Structures (ELIAS) experiment will be launched in February 1982 to gather data on the spatial variability of aurora infrared (IR) measurements.

Incorporation of this information into nuclear IR models will greatly enhance the capability to assess the effectiveness of

b. The initial flight of the Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS) space shuttle experiment, a joint United States Air Force and DNA experiment, is scheduled. Coincident with CIRRIS measurements, a rocketborne experiment will measure the atmospheric IR emissions, thus providing a calibration. The capability of the shuttle to make synoptic measurements will create a data base on natural variability and provide a test of our capability to model the ambient IR chemistry. This data base is necessary in order to be able to extrapolate to nuclear enhanced chemistry.

c. (U) Design and fabrication will be completed for the SCINTEC satellite borne experiment package in preparation for a late CY 1982 or early CY 1983 launch. This experiment will investigate high latitude plasma structuring processes. A laboratory experiment will be designed to investigate the plasma structuring and debris transport processes that operate in the first second

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following a high altitude nuclear explosions. This experiment supports both scintillation and long wavelength infrared (IR) radiation (LWIR) problems.

d. An experimental effort in polar regions disturbed by solar proton events will provide much needed transverse electric (TE) very low frequency (VLF) transmission data. An aircraft will be instrumented to measure high frequency (HF) absorption

3. (U) FY 1983 PLANNED PROGRAM:

a.

The initial auroral experiment in the DNA program SPIRIT, an earthlimb viewing auroral LWIR measurement rocketborne experiment.

b. (U) The high latitude structure/scintillation satellite experiment will be launched. An experimental campaign will be conducted using radars and possibly rocket probes to complement SCINTEC. The data will be used to confirm or improve theoretical models of high latitude plasma structure processes. A laboratory early time nuclear time plasma structuring and debris transport experiment will be initiated; this experiment will gather data which will be used to improve nuclear predictive capabilities for command, control and communications (C³) radar systems and for IR surveillance systems. An extremely low frequency (ELF) propagation experiment in solar event disturbed polar regions will be undertaken. Analysis of data from the HF absorption experiment will be performed; information will be evaluated for adequacy or possible experiment improvements. Engineering tests of metal oxide release methods will be tested and initial measurements of the resultant LWIR emissions will be acquired. The Rocketborne Electron Accelerator (EXCEDE) will be augmented to measure the IR signatures of slow chemistry. Data gathering and experiments will continue using the SCINTEC satellite and ground diagnostics. The data will be used to upgrade both ambient and nuclear signal scintillation prediction models.

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(U) Budget Activity: #1 - Technology Base

4. (U) FY 1984 PLANNED PROGRAM: The main objectives and thrust of FY 1983 will continue.
5. (U) PROGRAM TO COMPLETION: This is a continuing program.
6. (U) MILESTONES:

FY 1982 Initiate link testing of the Integrated Optical Nuclear Detection System (IONDS). Initiate a polar experimental program to support the development of a high latitude nuclear effects prediction capability which includes satellite beacon and magnetic measurements, aircraft, radar, and possibly rocket probes of the disturbed ionosphere. Execute feasibility investigation to evaluate inertial confinement fusion (ICF) facilities for use in investing early time high altitude nuclear weapons effects. Conduct uranium oxide laboratory measurements of long wave infrared (IR) emissions. Conduct very low frequency (VLF) propagation experiments. Conduct the Earth Limb Infrared Auroral Structure (ELIAS) experiment. First flight of Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRIS). Complete assembly and test of equipment for high frequency (HF) absorption experiment.

FY 1983 (U) Complete payload definition for a Rocketborne Electron Accelerator (EXCEDE) experiment. Acquire the first measurements of long wavelength infrared (LWIR) emissions from aurorally disturbed atmosphere for application to nuclear effects codes. Complete the link testing of the IONDS and Defense Support Program (DSP) Mobile Ground Terminals using the link simulator. Perform early time nuclear weapons effects experiments.

FY 1984 (U) Complete engineering test for Weapons Debris Metal Oxide Release experiment in conjunction with the space shuttle experiment, CIRRIS, reflight. Conduct the EXCEDE late time IR experiment. Execute combined high latitude structure experiments. Execute early time structure experiments.

FY 1985 (U) Conduct the second joint United States Air Force/DNA space shuttle experiment to measure spatial structure in excited atmosphere IR emissions. Conduct Weapons Metal Oxide Release experiment to obtain IR emission characteristics. Execute the high latitude structure experiment.

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				(\$ in Thousands)	
	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COST TO COMPLETION</u>
7. (U) <u>RESOURCES</u> : Effects Simulation Using Natural Disturbances	7,522	10,400	11,800	14,000	Continuing

a. (U) BASIS FOR FY 1983 REQUEST: The bases for the request are requirements to extend the satellite communications investigations to higher frequencies, to investigate nuclear effects on radio propagation, radar and laser systems and on space based infrared (IR) sensors.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM 1982: The increased emphasis on enhancing the technology base for predicting nuclear IR effects on long wavelength infrared (LWIR) systems and for predicting high latitude nuclear effects on communications is reflected in the level of effort. These predictions will be used in the design and nuclear mission capability assessment of developing space and ballistic missile defense systems which use the LWIR for detection. Critical high latitude communications links will be assessed and nuclear effects mitigation techniques developed as well.

DEFENSE NUCLEAR AGENCY
FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: J

(U) Title: Underground Nuclear Tests

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. DETAILED BACKGROUND AND DESCRIPTION: Underground nuclear weapons effect tests (NWET) are conducted by DNA in response to defense requirements for nuclear weapons effects information. The requirements are submitted annually by the Services and the Department of Energy (DoE) laboratories. The underground NWET program consists of a comprehensive series of test events specifically designed to obtain vital experimental information required for weapon system managers to meet program milestones and operational acceptance dates. Each event in the NWET series is limited to the minimum essential participation relevant to current Department of Defense (DoD) missions. Thorough technical scrutiny of each requirement limits the NWET events to those experiments which cannot be satisfied by simulation techniques or calculational methods. Event testbed preparation and experimental techniques are closely monitored to identify possible methods of cost reduction. Underground test program emphasis has been on vulnerability and hardness.

Testing of the | their components and subsystems, to meet project milestones will continue to be of special emphasis in the future events.

G. (U) RELATED ACTIVITIES: The underground NWET program also provides important source data for research on energy coupling, containment mechanisms, ground shock propagation, and amplitude yield scaling related to monitoring the extent of compliance with the Threshold Test Ban Treaty (TTBT).

H. (U) WORK PERFORMED BY: DoD agencies, other United States Government agencies, civilian contractors and nonprofit organizations and educational institutions. Principal DoD agencies include Air Force Ballistic Missile Office, Air Force Space Division, Air Force Weapons Laboratory, Harry Diamond Laboratories (Army); Ballistic Missile Division (Army) and Naval Surface Weapons Center. A Government agency is the Defense Advanced Research Projects Agency (DARPA). Some typical major contractors are the Boeing Co., Lockheed Missiles and Space Co., Pacifica Technology, Physics International Co., Science Applications, Inc., Systems, Science and Software, Inc., Kaman Sciences Corp., EG&G, JAYCOR, BENDIX Field Engineering Inc., Pan Am, Reynolds Engineering Company, and General Electric Corp. Educational institutions include University of California, Los Alamos National Laboratory/Lawrence Livermore National Laboratory.

(U) Project #: 2

(U) Title: Underground Nuclear Tests

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

1. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS: DNA has conducted eleven underground nuclear weapons effects tests in the HURON LANDING series which began with HUSKY ACE in 1973. HURON KING, executed 24 June 1980, was the first DNA vertical line-of-sight (VLOS) since 1971. It provided a weapons effects test to determine the systems generated electromagnetic pulse response of the analysis and research satellite (STARSAT), a satellite similar to the Defense Satellite Communications System III (DSCS III). The MINERS IRON event, conducted 31 October 1980,

Planning was initiated on an augmented test program with emphasis on the next two follow-on events: (1) HURON LANDING, test scheduled for September 1982, and (2) DIAMOND ACE, also scheduled for September 1982, will look at source (device) output of a low yield device.

2. (U) FY 1982 PROGRAM:

a. HURON LANDING - Readiness Date: September 1982. This event is a horizontal line-of-sight (HLOS) test largely dedicated to the validation of the M-X system, including booster and reentry bodies.

b. (U) DIAMOND ACE - FY 1982 will complete the testbed construction to support a concurrent detonation with HURON LANDING. It is the first event in the DISTANT ARBOR series which is designed to develop a low yield test capability.

c. MIDAS MYTH - Initial planning and construction for event MIDAS MYTH (Readiness Date: September 1983) will commence. This will be a HLOS test mainly in support of the Advanced Ballistic Reentry Vehicle (ABRV) missiles system generated electromagnetic pulse (SGEMP) and Department of Energy (DoE) component development.

d. (U) DIAMOND BEECH - Initial planning, design and testbed construction will begin for this event (Readiness Date: March 1983). DIAMOND BEECH will be primarily devoted to developing sample (test article) protection for low yield tests.

(U) Project #: J

(U) Title: Underground Nuclear Tests

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

3. (U) FY 1983 PLANNED PROGRAM:

- a. (U) DIAMOND BEECH - Testbed construction will be completed to support a March 1983 readiness date.
- b. (U) MIDAS MYTH - It is planned to complete the testbed, emplace the experiments and execute the event.
- c. MISTY RAIN (Readiness Date: May 1984) - Initial planning and construction for this event will start. This event will be a vertical line-of-sight (VLOS).
- d. MISTY JADE (Readiness Date: May 1985) - Initial planning and preliminary for this event will commence. MISTY JADE is planned as an underground detonation.
- e. MIDDLE NOTE - FY 1983 efforts will initiate planning and testbed design for event MIDDLE NOTE (Readiness Date: July 1985) - This event is planned as a horizontal line-of-sight (HLOS) missile to SGEMP. As such, the test missile will be located in a large chamber with a large scatterer.

4. (U) FY 1984 PLANNED PROGRAM:

- a. (U) MISTY RAIN - It is planned to complete the testbed and execute the event.
- b. MISTY JADE - FY 1984 efforts will consist of detailed test design as well as in preparation for a May 1985 readiness date.
- c. (U) MIDDLE NOTE - FY 1984 efforts will encompass planning, experiment definition, test design, mining and initiate HLOS pipe and chamber construction in preparation for a July 1985 readiness date.

(U) Project #: J

(U) Title: Underground Nuclear Tests

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

d. UN-NAMED EVENT (No. 3 in the DISTANT ARBOR series) - in FY 1984 efforts for this event (Readiness Date: September 1985) will encompass experiment definition and testbed construction.

e. MIGHTY OAK - Initial planning and test design for event MIGHTY OAK (Readiness Date: May 1986) will commence. This event is planned as a HLOS.

f. UN-NAMED EVENT (No. 19 in HUSSAR SWORD series) - in FY 1984 efforts for this event (Readiness Date: September 1986) will consist of preliminary planning and test design for a HLOS.

5. (U) PROGRAM TO COMPLETION: This is a continuing program of investigating the effects of nuclear explosions. As different effects become significant or new weapons systems are developed underground nuclear tests are conducted to assess system survivability/vulnerability. Simulation techniques will be used to the maximum extent feasible, but it is not foreseen that it will be possible to simulate all of the effects adequately in the foreseeable future.

6. (U) MILESTONES: The milestones planned for FY 1982 and FY 1983 in this submission, do differ significantly from those planned for the same years in the January 1981 submission.

FY 1982: a. (U) DIAMOND BEECH: Initial design efforts will start in October 1981, testbed construction commences in March 1982, and the HLOS pipe fabrication will begin in July 1982.

b. (U) DIAMOND ACE: Testbed construction will start in October 1981. Construction and experiment emplacement will be finished by August 1982 to meet a September readiness date.

c. (U) HURON LANDING: HLOS pipe construction will be started in January 1982. All testbed construction and experiment emplacement will be complete in August to support a test execution readiness in September 1982.

(U) Title: Underground Nuclear Tests

(U) Title: Defense Nuclear Agency (DNA)

(U) Budget Activity: #1 - Technology Base

FY 1983: a. (U) DIAMOND BEECH: Horizontal line-of-sight (HLOS) pipe construction will be started in November 1982. All testbed fabrication will be completed in February 1983 to support a readiness date in March 1983.

c. (U) MISTY RAIN: Initial design efforts will begin in November 1982 and the vertical line-of-sight (VLOS) construction will start in May 1983.

d. (U) MIDDLE NOTE: Design and fielding activities will start in July 1983.

				(\$ in Thousands)	COST TO	
		FY 1981	FY 1982	FY 1983	FY 1984	COMPLETION
7. (U) RESOURCES:	Underground Nuclear Tests	30.592	65.800	97.500	114.600	Continuing

a. BASIS FOR FY 1983 REQUEST: Mining for the MIDAS MYTH and DIAMOND BEECH events will be completed, HLOS construction finished, and the events will be executed. Initial planning and testbed design will be accomplished for MISTY RAIN, MISTY JADE, and MIDDLE NOTE. Construction of the VLOS pipe will begin on MISTY RAIN. for MISTY JADE will be initiated.

b. (U) BASIS FOR CHANGE IN FY 1983 FROM 1982: The higher funding is due to an increase in the number of underground nuclear weapons effects tests as well as a major refurbishment and modification of the facilities and instrumentation at the Nevada Test Site (NTS). The added test events are to support identified critical experiments in the areas of (1) systems

(U) Project #: J

(U) Title: Underground Nuclear Tests

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology

development, such as responses of advanced missile materials and understanding and controlling system generated electromagnetic pulse (SGEMP), (2) the investigation of nuclear weapons phenomenology, e.g., a cratering physics test, and (3), the development of more responsive testing techniques. Both the increase in underground experimentation and the test site upgrade program are multi-year funded beginning in FY 1982.

DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(THIS SUMMARY IS UNCLASSIFIED)

Project #: A

Title: Theater Nuclear Force Survivability, Security and Safety (TNFS³)

Program Element #: 6.27.15.H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

F. DETAILED BACKGROUND AND DESCRIPTION:

1. The objective of the Theater Nuclear Force Survivability, Security and Safety project is to ensure that the theater nuclear forces (warheads; delivery systems; command, control and communications; and logistics) are sufficiently survivable, safe and secure to serve as a credible nuclear deterrent and, if deterrence fails, to serve as a retaliatory counterbalance to numerically superior forces. The project examines current and future vulnerabilities of theater nuclear forces. Solutions are developed and validated to ensure survival to a full spectrum of threats. The programs are oriented to obtaining the greatest possible increase in overall theater nuclear forces effectiveness for the resources invested by the Defense Nuclear Agency and the Services.

2. The objective is accomplished by working in close cooperation with the Army, Navy, Air Force, theater commanders, Joint Chiefs of Staff and Department of Defense agencies throughout each project cycle - from problem identification to solution implementation. Support is provided for new materiel development as well as equipment modifications. It includes recommendations concerning policy, doctrine and procedure as well as physical improvements.

G. RELATED ACTIVITIES: This project supports Service activities by providing recommended enhancements to the theater nuclear forces. The project is managed under the direction of a Steering and Advisory Group with representatives from the Office of the Secretary of Defense, the Services, defense agencies, Joint Chiefs of Staff, and the Commander-in-Chiefs.

Project #: A

Title: Theater Nuclear Force Survivability, Security and Safety (TNFS³)

Program Element #: 6.27.15H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

H. WORK PERFORMED BY:

1. Department of Defense agencies, Department of Energy agencies, civilian contractors.
2. Contractors include: The BDM Corp.; JAYCOR; Pacific Sierra Research Corp.; R&D Associates; Mission Research Corp.; Science Applications, Inc.; General Research Corp.; and other contractors.
3. Government laboratories from the Department of Energy (Sandia National Laboratory, Los Alamos National Laboratory, Lawrence Livermore National Laboratories), and Department of Commerce (National Bureau of Standards) participate, as well as all the laboratories of the Department of Defense and Services.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 AND PRIOR ACCOMPLISHMENTS: A major accomplishment has been in the construction of an advanced design tactical aircraft shelter. This dual capable aircraft shelter is to be tested in early FY 1982 to determine new high explosive quantity-distance factors for reducing required shelter spacing on airbases. Another major Defense Nuclear Agency program is the development of a prototype bomb storage vault. This below-ground nuclear weapon storage vault will be installed in aircraft hangarages in order to improve weapon survivability, security and safety. This vault concept will be tested in FY 1982. In a program for security improvement in transporting weapons, four prototype armored ground transporters were constructed and feasibility demonstrations were initiated. Because of the threat to nuclear-armed ground launched cruise missiles by infiltrators, the Defense Nuclear Agency initiated a program to determine the effectiveness of various security procedural concepts. These concepts were evaluated in FY 1981 using two-sided force engagement field tests. For security enhancement of weapons storage sites, an operational feasibility test program was carried out using smoke, foams and other penetration preclusion devices. A major new initiative involved nuclear command, control and communication systems. Work in this area of activity commenced with the assessment of dispersed, modular command post concepts. Defense Nuclear Agency

Project #: A

Title: Theater Nuclear Force Survivability, Security and Safety (TNFS³)

Program Element #: 6.27.15H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

Research was also initiated to develop advance basing concepts, equipment and procedures for Navy antisubmarine aircraft. A new assessment of nuclear weapons effects on tactical weapons systems, such as Aegis, Terrier and Tomahawk, was initiated. A conceptual program was started for enhancing the survivability of Pershing and ground launched cruise missiles when not deployed or when on Quick Reaction Alert site.

2. FY 1982 PROGRAM. The Defense Nuclear Agency Theater Nuclear Force Survivability, Security and Safety project will continue the programs involving: protective shelters; security devices; storage; movement; and nuclear command, control and communication. Examples of specific continuing programs are: (1) Explosive testing of the advanced design shelter and nuclear bomb storage vault; (2) Testing of the armored transporter prototypes; (3) Assessment of techniques for rapid dispersal of nuclear weapons from storage and missile sites; (4) Testing of dispersed command post command, control and communication procedures; and (5) Assessment of nuclear weapons effects on survivability of Navy weapons systems.

3. FY 1983 PLANNED PROGRAM: The FY 1983 program will continue the efforts of earlier years with particular attention being given to hardening of naval surface ships to nuclear weapons effects. Programs involving shelters, advanced storage, movement, security devices, and rapid dispersal will be given further attention for transfer to and implementation by the Services.

4. FY 1984 PLANNED PROGRAM: In general, the project will continue the development of new methods (hardware and operational procedures) for enhancing the survivability, security and safety of nuclear forces. The primary focus in FY 1984 will be the validation and turnover to the Services of programs involving: armored container hardware; weapons storage vault; and procedures and hardware for operating dispersed antisubmarine warfare aircraft.

5. PROGRAM TO COMPLETION: In conjunction with the Services, the project will coordinate the development of selected survivability, security and safety enhancements. It will provide direct support to the weapons program offices for systems

Object #: A

Title: Theater Nuclear Force Survivability, Security and Safety (TNFS³)

Program Element #: 6.27.15H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

involving nuclear capabilities. Support will also be provided to the Services to ensure that the improvements identified, developed and tested are properly integrated in the overall nuclear force modernization program. In addition, the Defense Nuclear Agency will ensure the Services are aware of the technology base and analytical tools which are available to ensure survivability, security and safety of the theater nuclear force.

6. MILESTONES:

FY 1982 a. Provide data to the Department of Defense safety board on safe distance factors between aircraft magazines containing stored nuclear and conventional weapons.

b. Develop plan for prewar dispersal and temporary storage of air-delivered antisubmarine nuclear weapons.

c. Complete survivability tests of weapons storage vault.

d. Evaluate Navy nuclear weapon system survivability and reconstitution concepts.

FY 1983 a. Complete tests for alternate storage sites concepts for advanced storage concepts.

b. Complete development of advanced basing concept for Navy antisubmarine warfare aircraft.

FY 1984 a. Complete validation and turnover to the Services of weapons storage vault.

b. Continue development of advanced storage concepts.

Project #: A

Title: Theater Nuclear Force Survivability, Security and Safety (TNFS³)

Program Element #: 6.27.15H

Title: Defense Nuclear Agency (DNA)

DoD Mission Area: #540 - Defense Nuclear Agency

Budget Activity: #1 - Technology Base

- c. Develop and demonstrate concepts such as use of decoys and smoke obscuration.
- d. Evaluate integrated rapid dispersal options.

	<u>FY 1981</u>	<u>FY 1982</u>	(\$ in Thousands)		<u>COST TO</u>
			<u>FY 1983</u>	<u>FY 1984</u>	<u>COMPLETION</u>
7. <u>RESOURCES:</u> Theater Nuclear Forces Survivability, Security and Safety (TNFS ³)	14,139	8,900	7,100	6,000	Continuing

a. BASIS FOR FY 1983 REQUEST: The work accomplished in FY 1979 through FY 1981 and that planned for FY 1982 was developed in conjunction with the Services. A baseline, prioritized program has been developed and is now in progress. The basis for the FY 1983 request is a continuation of this prioritized program.

b. BASIS FOR CHANGES IN FY 1983 FROM FY 1982: In FY 1982, the majority of the program's effort will be directed toward the objectives of the prioritized baseline program. There will be a reduction in FY 1983, caused by the completion of development and testing of improvement options currently being pursued.

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DEFENSE NUCLEAR AGENCY

FY 1983 RDT&E DESCRIPTIVE SUMMARY

(U) Project #: B

(U) Title: Physical Security

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

F. DETAILED BACKGROUND AND DESCRIPTION: Physical security of nuclear weapons is a critical element which is vital to United States national security interests. The DNA is designated as the single authorized source within the Department of Defense (DoD) to initiate and fund exploratory research in support of Service requirements to safeguard these national resources. Traditional security philosophy and procedures historically focused on a covert threat posed by the terrorist, saboteur and espionage agent. Recent tests suggest

The above modus operandi could place

Global acts of terrorism mandate an immediate and concentrated effort to upgrade nuclear weapons security. Constraints on manpower and dollars dictate the most efficient and prudent use of these resources to insure adequate security. Program direction continues to focus towards research efforts that provide scientific validation of standards and procedures which insure effective security. This optimum level of achievable security is pursued through test, evaluation and validation of concepts and begins with proper planning and interface design, the development of security hardware and materials, and must also include human behavioral factors. The performance of concepts and the redesigned system is validated through testing, which is the final task element. A successful research and development program enhances our nuclear security posture and can successfully assist an expanded threat spectrum launched by a determined terrorist adversary.

G. (U) RELATED ACTIVITIES: This program supports all DoD and State activities concerned with the physical security of nuclear weapons, materials, chemical agents and public facilities. Joint research efforts of common interest to the Federal community in nuclear security are ongoing.

(U) Project #: B

(U) Title: Physical Security

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: # 540 - Defense Nuclear Agency

(U) Budget Activity: # 1 - Technology Base

H. (U) WORK PERFORMED BY:

1. (U) Department of Defense (DoD) laboratories; Army Mobility Equipment Research and Development Command; Army Civil Engineering Research Laboratory; Army Project Manager for Nuclear Munitions; Army Engineers; Naval Surface Weapons Center, White Oak; Naval Civil Engineering Laboratory; Naval Ordnance Station, Indian Head; Naval Personnel Development Center, San Diego; Naval Electronics Command; Air Force Office of Security Police; Air Force Systems Command; Rome Air Development Center; and the Air Force Electronics System Division.

2. (U) United States Government agencies include: Department of State; Law Enforcement Assistance Administration, National Bureau of Standards; and the Central Intelligence Agency.

3. (U) Civilian contractors and universities include: Sandia National Laboratories; University of California, Lawrence Livermore National Laboratory; Abbott Associates, Inc.; JAYCOR; Mission Research Corp.; Human Factors Research; Effects Technology, Inc.; and Adaptronics.

I. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1981 AND PRIOR ACCOMPLISHMENTS: As the single manager for the DoD experimental research program of physical security techniques and technology for the security of nuclear weapons, Service laboratories, academia, other Government agencies, and various commercial enterprises were funded within areas of human factors, concepts and new technologies for improving the security of nuclear weapons. Some of the major efforts include:

a. (U) Development of an intruder and weapon taggant/tracer system.

b. (U) Continuation of investigation into the human factors areas of nuclear security personnel, such as vigilance, selection, training and motivation.

(U) Project #: B

(U) Title: Physical Security

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: # 540 - Defense Nuclear Agency

(U) Budget Activity: # 1 - Technology Base

c. (U) An automated site security monitor and response system was conceptually developed utilizing new technologies and transmission capabilities.

d. (U) The development of a door relocking mechanism which may be used in the future to retrofit igloo doors.

e. (U) A site was selected for a Department of Defense (DoD) operational test site and preparations were made for an architectural engineering contract.

2. (U) FY 1982 PROGRAM:

a. (U) Continue the investigation of the behavioral assessment of nuclear security personnel.

b. (U) The furtherance of anticompromise emergency destruct technologies, and improvements in sensor signature data acquisition and evaluation methodologies which will enhance the detecting/deterring/defeating of intruders.

c. (U) Develop the operational test site which will support the integrated testing of the DoD nuclear security program.

d. (U) Demonstrate the feasibility of using fiber optics technology as a basis for a new low cost sensor for intrusion detection.

e. (U) Continue efforts toward developing a high security locking system for nuclear weapons storage structures.

(U) Project #: B

(U) Title: Physical Security

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

f. (U) Conduct further investigation into composite barrier materials (steel, plexiglass, lexan, titanium, etc.) to determine the type of barrier materials which would constitute an appropriate deterrent against cutting by drill, power saw, torch, shape charge and gunfire.

g. (U) Develop an optimally configured hybrid entry control system.

h. (U) Continue development of a computer site security monitoring and response system through the use of state-of-the-art computer based systems to enhance overall security of nuclear weapons.

3. (U) FY 1983 PLANNED PROGRAM:

a. (U) Continue efforts in assessing physiological and psychological effects on security forces.

b. (U) Test newly developed security systems using fiber optics as a sensing device and begin the development of a multivariate intrusion identification processor (MIIP).

c. (U) Continue efforts to record and analyze information passing through sensor communication networks of operational nuclear sites. Measure operational performance in existing systems in order that man related strengths and weaknesses of the system can be identified.

d. (U) Continue developing a prototype hardware/software sensor system utilizing distributed microprocessor data processing, adaptive learning networks and fiber optic data links.

e. (U) Complete the initial architectural engineering design of an operational test site at Fort McClellan, Alabama and begin construction.

(U) Project #: B

(U) Title: Physical Security

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: #540 - Defense Nuclear Agency

(U) Budget Activity: #1 - Technology Base

f. (U) Continue development of technologies for intruder tagging and tracing.

g. (U) Complete evaluation and test of barrier composite materials.

h. (U) Determine both the favorable/unfavorable effects command, control and communications (C³) have on a security system.

4. (U) FY 1984 PLANNED PROGRAM: The effort for this fiscal year will be a continuation of the research, development, test and evaluation efforts planned for FY 1983. This effort will continue to identify security systems that will provide proper detection with a lower nuisance/false alarm rate.

5. (U) PROGRAM TO COMPLETION: This is a continuing program that works toward optimum security policies, procedures and criteria for the Department of Defense (DoD) nuclear weapons arsenal and attempts to preclude the necessity for hastily organized programs. The ongoing program not only satisfies the requirement for near term modernization and security upgrade, but should also provide a viable integrated security system for the 1990s.

6. (U) MILESTONES:

FY 1982 a. (U) Complete the behavioral assessment effort for the Air Force concerning physical security positions and personnel performance; the radio frequency signature assessment project; and the development of an entry control system.

b. (U) Assess the results of the weapons access delay system (WADS) tests and determine the optimum subsystem that will provide the best access delay for the money.

(U) Project #: B

(U) Title: Physical Security

(U) Program Element #: 6.27.15.H

(U) Title: Defense Nuclear Agency (DNA)

(U) DoD Mission Area: # 540 - Defense Nuclear Agency

(U) Budget Activity: # 1 - Technology Base

equipment. c. (U) Continue the development of an operational test site, to include procurement of initial test

application. d. (U) Optimize the charged couple device with moving target indicator for physical security

FY 1983 a. (U) Complete initial architectural design of the operational test site and initiate construction.
transducers. b. (U) Develop design for a general purpose microprocessor capable of interface with a variety of

c. (U) Complete effort to record and analyze information passing through communication sensors and recommend a system which can be procured by the Service for training/assessment purposes.

d. (U) Continue development of a hardware/software sensor system using adaptive learning networks.

e. (U) Continue the development of an olfactory sensor and a laser enhanced ionization detection device.

FY 1984 a. (U) Complete research in the development of a computerized site security monitoring and response system.

b. (U) Complete the design and construction of the operational test site; plan for future operational tests.

c. (U) Complete the design and development of high security locking systems and incorporate into Department of Defense (DoD) Manual 5210.41-M, Nuclear Weapon Security Manual.

(U) Title: Physical Security

(U) Title: Defense Nuclear Agency (DNA)

(U) Budget Activity: #1 - Technology Base

		(\$ in Thousands)		COST TO
<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>COMPLETION</u>
5,331	7,800	9,600	11,600	Continuing

b. (U) BASIS FOR CHANGE IN FY 1983 FROM FY 1982: The FY 1983 increase is attributable to the high priority effort to establish a DoD Operational Test Site at Fort McClellan, Alabama. Essentially, FY 1982 funded research projects will continue at the same or reduced levels to allow sufficient resources to be applied to the Test Site undertaking.

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Research, Development, Test, and Evaluation, Defense Agencies

DLA

08 FEB 82

Program and Financing (in thousands of dollars)

Identification code 97-0400-0-1-051		Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
6.	Defensewide mission support	16,215	17,774	22,700	16,430	18,042	22,310
	Reimbursable program	3,054	3,500	3,500	3,077	3,500	3,500
10 0001	Total	19,269	21,274	26,200	19,507	21,542	25,810
Financing:							
Offsetting collections from:							
11 0001	Federal funds	-3,054	-3,500	-3,500	-3,077	-3,500	-3,500
	Unobligated balance available, start of year:						
21 4001	For completion of prior year budget plans				-1,119	-853	-585
21 4002	Reprogramming from or to prior year budget plan	-51					
24 4001	Unobligated balance available, end of year				853	585	975
25 0001	Unobligated balance lapsing	51			51		
40 0001	Budget authority (appropriation)	16,215	17,774	22,700	16,215	17,774	22,700

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Research, Development, Test, and Evaluation, Defense Agencies

DLA

08 FEB 82

Object Classification (in thousands of dollars)

Identification code	97-0400-0-1-051	1981 actual	1982 est.	1983 est.
Direct obligations:				
Personnel compensation:				
111.101	Full-time permanent	9,346	10,518	11,710
111.301	Other than full-time permanent	95		
111.501	Other personnel compensation	194		
111.901	Total personnel compensation	9,635	10,518	11,710
112.101	Civilian personnel	958	1,081	1,205
121.001	Travel and transportation of persons	41	100	65
122.001	Transportation of things	9	15	20
123.201	Communications, utilities and other rent	1,028	1,520	1,747
124.001	Printing and reproduction	165	200	220
Other services:				
125.003	Contracts	3,564	3,786	6,009
126.001	Supplies and materials	658	604	648
131.001	Equipment	372	218	686
199.001	Total direct obligations	16,430	18,042	22,310
Reimbursable obligations:				
Personnel compensation:				
211.101	Full-time permanent	301	239	249
212.101	Civilian personnel	29	23	25
Other services:				
225.003	Contracts	2,675	3,160	3,146
226.001	Supplies and materials	72	78	80
299.001	Total reimbursable obligations	3,077	3,500	3,500
999.901	Total obligations	19,507	21,542	25,810

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
PERSONNEL SUMMARY

	<u>FY 1981 PROGRAM</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>
Total Number of Permanent Positions	430	450	475	475
Total Compensable Work Years	433	441	475	475
Full-Time Equivalent of Other Positions	(4)	(4)	(4)	(4)
Full-Time Equivalent of Overtime and Holiday Hours	(7)	(7)	(7)	(7)
Average Paid Employment	433	441	475	475
Average GS Grade	8.49	8.50	8.50	8.50
Average GS Salary	23,083	24,429	24,746	24,746
Average Salary of Ungraded Positions	18,934	20,138	20,344	20,344

DEPARTMENT OF DEFENSE - MILITARY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
DEFENSE LOGISTICS AGENCY
(\$ in Thousands)

	<u>FY 1981 Program</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
-----SUMMARY BY BUDGET ACTIVITY-----				
6. Defense-Wide Mission Support	<u>16,215</u>	<u>17,774</u>	<u>22,700</u>	<u>25,005</u>
TOTAL RDT&E - Direct	<u>16,215</u>	<u>17,774</u>	<u>22,700</u>	<u>25,005</u>
Reimbursements	<u>3,100</u>	<u>3,500</u>	<u>3,600</u>	<u>3,700</u>
TOTAL PROGRAM	<u>19,315</u>	<u>21,274</u>	<u>26,300</u>	<u>28,705</u>

-----SUMMARY BY PROGRAM CATEGORY-----				
6. Defense-Wide Mission Support	<u>16,215</u>	<u>17,774</u>	<u>22,700</u>	<u>25,005</u>
TOTAL Research and Development (Program 6)	<u>16,215</u>	<u>17,774</u>	<u>22,700</u>	<u>25,005</u>
TOTAL Operational Systems Program	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
TOTAL RDT&E - Direct	<u>16,215</u>	<u>17,774</u>	<u>22,700</u>	<u>25,005</u>
Reimbursements	<u>3,100</u>	<u>3,500</u>	<u>3,600</u>	<u>3,700</u>
TOTAL PROGRAM	<u>19,315</u>	<u>21,274</u>	<u>26,300</u>	<u>28,705</u>

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Research, Development, Test, and Evaluation, Defense Agencies

DLA

08 FEB 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
	6. Defensewide mission support				1,066			
	Reimbursable program				23			
10.0001	Total				1,091			
Financing:								
Offsetting collections from:								
11.0001	Adjustment to prior year federal fund order				-23			
	Unobligated balance available, start of year:							
21.4001	For completion of prior year budget plans				-1,119			
21.4002	Reprogramming from or to prior year budget plan	-51						
25.0001	Unobligated balance lapsing	51			51			
40.0001	Budget authority (appropriation)							

Hessler

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
	6. Defensewide mission support	16,215			15,362	853		
	Reimbursable program	3,054			3,054			
10.0001	Total	19,269			18,416	853		
Financing:								
Offsetting collections from:								
11.0001	Federal funds	-3,054			-3,054			
21.4001	Unobligated balance available, start of year					-853		
24.4001	Unobligated balance available, end of year				853			
40.0001	Budget authority (appropriation)	16,215			16,215			

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Research, Development, Test, and Evaluation, Defense Agencies

DLA

08 FEB 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code		Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
6. Defensewide mission support			17,774			17,189	585
Reimbursable program			3,500			3,500	
10.0001	Total		21,274			20,689	585
Financing:							
Offsetting collections from:							
Federal funds			-3,500			-3,500	
21.4001	Unobligated balance available, start of year						-585
24.4001	Unobligated balance available, end of year					585	
40.0001	Budget authority (appropriation)		17,774			17,774	

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code		Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
6. Defensewide mission support				22,700			21,725
Reimbursable program				3,500			3,500
10.0001	Total			26,200			25,225
Financing:							
Offsetting collections from:							
Federal funds				-3,500			-3,500
24.4001	Unobligated balance available, end of year						975
40.0001	Budget authority (appropriation)			22,700			22,700

DEPARTMENT OF DEFENSE-MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
PERFORMER DISTRIBUTION
(\$ in Thousands)

Appropriation: RDT&E, Defense Agency

	TOTAL DIRECT OBLIGATION AUTHORITY			
	<u>FY 1981 PROGRAM</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>
1. For Operation of Installations of the Reporting DoD Component (Government-Operated).....	12,439	13,752	16,172	16,693
2. For Operation of Installations of the Reporting DoD Component (Contractor-Operated).....	-	-	-	-
3. For Contracts <u>Directly in Support</u> of Work Actually Per- formed at Installations of the Reporting DoD Component.....	93	71	504	543
4. For Work Assigned to Activities of Other DoD Activities.....	110	10	220	220
5. For Work Assigned to Activities of Other Government Agencies.....	690	699	734	1,084
6. For Work Performed by Industrial Contractors ("Profit" Organizations).....	-	270	365	475
7. <u>For Work Performed by Education Institutions:</u>				
a. Designated Federal Contract Research Centers.....	-	-	-	-
b. Other Institutions.....	865	775	1,000	1,400
8. <u>For Work Performed by Other "Non-Profit" Organizations:</u>				
a. Designated Federal Contract Research Centers.....	11	52	150	150
b. Other Institutions.....	<u>2,007</u>	<u>2,145</u>	<u>3,555</u>	<u>4,440</u>
9. Total RDT&E Appropriation.....	16,215	17,774	22,700	25,005

DEPARTMENT OF DEFENSE - MILITARY
 DEFENSE LOGISTICS AGENCY
 RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
 FEDERAL CONTRACT RESEARCH CENTERS
 (\$ in Thousands)

SUMMARY BY APPROPRIATION/PROJECT

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>
<u>INSTITUTE FOR DEFENSE AGENCIES</u>			
<u>Research, Development, Test & Evaluation, Defense Agencies (DLA)</u>			
6.58.01S.....	11	52	150

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
INSTALLATION ANALYSIS - IN-HOUSE

TOA (\$ IN THOUSANDS)										PERSONNEL (MAN-YEARS)							
Installation & Location	FY	RDT&E FUNDS			All Other Funds 1/	Sub - Total	MIL. PERS.		Total	CIVIL SERVICE			CONTRACTOR		MIL. PERS.		Total
		Mgt Bureau Etc.	Other Parent Dept	Other DoD			RDT&E	Other		Paid From Parent Agency	Paid From RDT&E	Paid From Other	Paid From RDT&E	Paid From Other	In RDT&E Work	Other	
Defense	81			12,054						429						429	
Technical	82			13,752						441							441
Information Center, Alex., VA	83			16,172						465							465
1/ Excludes Military Personnel and Military Construction																	

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
PROGRAM ELEMENT LISTING
(\$ in Thousands)

Program-wide Management and Support

<u>Element Code</u>	<u>Title</u>	<u>FY 1981 PROGRAM</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>	<u>FY 1984 ESTIMATE</u>	<u>Descriptive Summary Page</u>
	<u>DIRECT:</u>					
65801S	Defense Technical Information	13,233	14,574	17,560	18,470	551
65802S	Information Analysis Centers	2,982	3,200	5,140	6,535	569
	Total - DIRECT	16,215	17,774	22,700	25,005	
	<u>REIMBURSEMENTS</u>					
65801S	Defense Technical Information	1,100	1,330	1,330	1,330	
65802S	Information Analysis Centers	<u>2,000</u>	<u>2,170</u>	<u>2,270</u>	<u>2,370</u>	
	Total - REIMBURSEMENTS	<u>3,100</u>	<u>3,500</u>	<u>3,600</u>	<u>3,700</u>	
	GRAND TOTAL	<u>19,315</u>	<u>21,274</u>	<u>26,300</u>	<u>28,705</u>	

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

A. RESOURCES/PROJECT LISTING:

(\$ IN THOUSANDS)

Project Number	Title	FY 1981 Program	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	13,233	14,574	17,560	18,470		
1.0	RDT&E Information Services	1,737	2,115	2,843	2,974	Continuing	Not Applicable
2.0	Technical Report Services	5,017	5,489	6,027	6,079	Continuing	Not Applicable
3.0	Development	655	599	1,061	1,479	Continuing	Not Applicable
4.0	Systems Maintenance and Operational Improvements	2,247	2,372	2,842	3,066	Continuing	Not Applicable
5.0	Management and Support	3,577	3,999	4,787	4,872	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT:

Provides for the operation of the Defense Technical Information Center (DTIC) as the centralized Department of Defense facility for collecting, storing and retrieving scientific and technical information (S&TI) regarding Department of Defense Research and Development completed, ongoing, and planned efforts. The data are available to the users in their areas of technical interest and provide a means of improving the management of and reducing the costs of the overall Department of Defense Research, Development, Test, and Evaluation program.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

C. BASIS FOR FY 1983 RDT&E REQUEST:

The Defense Technical Information Center's mission consists of three basic and two support projects. Basic projects are: 1.0, RDT&E Information Services, providing for a centralized Department of Defense point for input, storage, retrieval, and transfer of Department of Defense Research, Development, Test, and Evaluation information on current and planned research efforts; 2.0, Technical Report Services, providing for a central facility within the Department of Defense for collection, storage, announcement, and secondary distribution of technical reports of completed efforts generated by Department of Defense sponsored Research, Development, Test, and Evaluation; and 3.0, Development, covering the DTIC efforts devoted to identification of requirements for new scientific and technical information products, services, and systems and evaluation to include feasibility and concept formulation. Support efforts at DTIC for the basic projects are: 4.0, Systems Maintenance and Operational Improvements, providing for the application of existing techniques, equipment, and technology to operating systems and to extend these capabilities or improve their performance and to design operating systems to implement approved new programs/ services; and 5.0, Management and Support, providing for normal management and support functions of the Center including management operations, administrative equipment and supplies, normal housekeeping services, and the technical terminology and Scientific and Technical Information central registry functions common to DTIC's mission.

D. BASIS FOR INCREASE IN FY 1983 OVER 1982:

Additional workyears, planned purchase of automatic data processing equipment (ADPE), and replacement equipment result in increased funding in 1983.

E. PERSONNEL IMPACT:

The number of employees supported with requested FY 1983 funds is as follows:

	<u>RDT&E</u>	<u>Procurement</u>	<u>Total</u>
(1) Federal Civilian Employees	475	0	475
(2) Contractor Employees	<u>0</u>	<u>0</u>	<u>0</u>

F. TERMINATION COST:

Not Applicable.

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #1.0

Title: RDT&E Information Services

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

BACKGROUND AND DESCRIPTION: This program provides for rapid access of technical management and program planning data in various information data banks at the Defense Technical Information Center. Summarized scientific and technical information on current Defense-sponsored research and technology plans, projects, and work units is provided to Defense research and development personnel and their contractors. Included are the Research and Technology Work Unit Data Bank, Research and Development Program Planning Data Bank, and the Independent Research and Development Data Bank. Unclassified Department of Defense information relating to ongoing research and technology efforts provided to interagency activities such as the Smithsonian Science Information Exchange and the Committee on Academic Science and Engineering of the Federal Council for Science and Technology. Included in this project are the operational requirements of the Research, Development, Test, and Evaluation On-Line System.

RELATED ACTIVITIES: No similar centralized Department of Defense program exists.

WORK PERFORMED BY: Input and output from the data banks are performed in-house by the Defense Technical Information Center. In keeping with Department of Defense policy, computer programs for operating systems within the project are written and maintained in-house.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. **FY 1981 and Prior Accomplishments:**

a. Since FY 1972 output services have been available from the Research and Technology Work Unit Data Bank, the Research and Development Program Planning Data Bank and the Independent Research and Development Data Bank. In 1973 operational status of the Research, Development, Test, and Evaluation On-Line System was achieved which permitted remote terminal access into the data collection of the Defense Technical Information Center. At the end of FY 1980, there were 100 remote access terminals connected to the system and 10 terminals for providing input to the files. FY 1980 workloads, including changes to the data base records, were 405,000.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #1.0

Title: Technical Report Services

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

b. In FY 1981, expansion of the Research, Development, Test, and Evaluation On-Line System continued. A total of 380 terminals were used for retrieval. Workloads, including changes to the data base records, were 438,000 transactions, including 310,000 searches from remote terminal users.

2. FY 1982 Planned Program

a. In FY 1982, 105 terminals will be added to the Research, Development, Test, and Evaluation On-Line System. The estimated workload to be performed is 542,000 transactions, including 400,000 remote terminal searches.

b. Increased funding requirements in FY 1982 over FY 1981 are due primarily to increased communications expenses and prorated share of rental and maintenance of newly acquired ADP and reproduction equipment. A 4.8% pay raise is included.

3. FY 1983 Planned Program

a. Estimated workload is 624,000 transactions including 470,000 remote terminal searches.

b. Increased funding requirement for FY 1983 is due to additional workyear requirements to accomplish new mission assignment of Manpower and Training Research Information System (MATRIS).

4. FY 1984 Planned Program

a. Estimated workload is 685,000 transactions, including 530,000 remote terminal searches.

b. Funding requirements for FY 84 are not significantly changed from FY 83 requirements.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #1.0

Title: RDT&E Information Services

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

5. Program to Completion

This is a continuing program.

RESOURCES: (IN THOUSANDS OF DOLLARS)

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>Completion</u>	<u>Cost</u>
RDT&E: Funds	1,737	2,115	2,843	2,974	Continuing	Not Applicable

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #2.0

Title: Technical Report Services

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity #6 Program-wide Management and Support

BACKGROUND AND DESCRIPTION: The Defense Technical Information Center is the central facility of the Department of Defense for secondary distribution of technical reports generated by research, development, test, and evaluation efforts sponsored by the Department of Defense. The Center acquires technical documents, stores them for retrieval, announces them for official use, and supplies copies to Federal agencies and to their registered contractors, subcontractors, and grantees. The Defense Technical Information Center furnishes on demand, or automatically, full-text copies of reports (in full size or microimage formats) and search bibliographies. The availability of new Department of Defense classified and limited reports is announced in the Defense Technical Information Center Technical Abstract Bulletin (TAB) and unclassified and unlimited documents in the Department of Commerce (DoC) Government Reports Announcements and Indexes (GRA&I). Announcement (TAB) documents are distributed every 2 weeks with Indexes.

RELATED ACTIVITIES: Initial distribution of domestic technical documents is made by the performing military service to Department of Defense research and development engineering and scientific personnel and their contractors. Acquisition and storage of these documents at the Defense Technical Information Center provide a facility for centralized secondary distribution of unclassified, limited, and classified documents to other Department of Defense research and development activities and their contractors when they are registered with Defense Technical Information Center. Within Department of Defense, this service is not duplicated.

WORK PERFORMED BY: The Defense Technical Information Center provides and performs services for input and announcement of unclassified, limited, and classified documentation in-house, including the bibliographic service. Composition for Defense Technical Information Center's TAB and Indexes is performed by the Government Printing Office (GPO). Actual printing of the Defense Technical Information Center's TAB and Indexes is performed in-house. Composition and printing of the Quarterly and Annual Indexes are performed by the Government Printing Office.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #2.0

Title: Technical Report Services

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. FY 1981 and Prior Accomplishments:

a. In FY 1981, as well as in prior years, the acquisition and secondary distribution of Department of Defense technical reports were accomplished by the Defense Technical Information Center.

b. During FY 1981, 1,280,000 transactions were processed, including new input and changes to the data bank. Reports distributed and products furnished from the data bank included 87,110 document requests that required special handling.

2. FY 1982 Planned Program:

a. Estimated workload for FY 1982 is 1,296,000 transactions, including changes, and 90,160 transactions requiring special handling of document requests.

b. Increased funding requirements in FY 1982 over FY 1981 result from the rental of newly acquired ADP and reproduction equipment. A pay increase of 4.8 percent has been included in the funding requirements.

3. Fy 1983 Planned Program:

a. Estimated FY 1983 workload is 1,330,000 transactions, including changes to the data bank.

b. Increased funding requirements in FY 1983 result from the purchase of replacement and previously-leased ADP and reproduction equipment.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #2.0

Title: Technical Report Services

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

4. FY 1984 Planned Program:

Estimated workload is 1,353,000 transactions including changes to the data bank.

5. Program to Completion:

This is a continuing program.

RESOURCES: (IN THOUSANDS OF DOLLARS)

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RDT&E: Funds	5,017	5,489	6,027	6,079	Continuing	Not Applicable

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #3.0

Title: Development

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

BACKGROUND AND DESCRIPTION: This program is directed towards developing and installing new information products, services, and systems; determining and fulfilling user requirements; and promoting transfer of technical information on a Defense-wide basis.

RELATED ACTIVITIES: No similar centralized DoD program exists.

WORK PERFORMED BY: The development effort is performed in-house for the most part; however, the Defense Technical Information Center does contract, on a short term basis, one-time development efforts for which it would be uneconomical to hire and maintain in-house staff and equipment capabilities on a continuing basis.

PROGRAM ACCOMPLISHMENTS AND FUTURE PLANS:

1. FY 1981 and Prior Accomplishments:

In prior years, the Defense Technical Information Center's development effort resulted in:

- a. The Defense Research, Development, Test, and Evaluation On-Line System (DROLS) which provides interactive access to DTIC-maintained data bases of technical and management Research, Development, Test, and Evaluation data via remote telecommunications terminals.
- b. An Information Analysis Center service support program to allow the Information Analysis Centers to share the centralized document and automated data processing facilities of the Defense Technical Information Center.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #3.0

Title: Development

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management Support

2. FY 1982 Planned Program:

- a. Development of a DTIC ADP Time Sharing Facility for DoD RDT&E managers' use.
- b. Establishment of an annual STI Research Seminar to broaden the base of STI research efforts within the DoD research community.
- c. Assist OSD MRA&L with the development of the Manpower and Training Research Information System (MATRIS) and assume operational control of the system.
- d. Continue development of the DoD Data Base of Data Bases.
- e. Implement and assess free text retrieval capabilities for DTIC management data bases.
- f. Investigate possibility of replacing the current management planning data base (DD 1634) with a data base of Congressional Summary information.
- g. Implement improved on-line terminal operator retrieval training.
- h. Based on completed feasibility study, implement selective prototype alternative to hard copy documents. Specifically, DTIC will develop a new system to accept microfiche in lieu of hard copy and will modify existing systems to accept camera ready copy in lieu of hard copy reports.
- i. Investigate feasibility of establishing a data base of DoD technical manuals.
- j. Increased funding requirements in FY 1982 over 1981 are attributable to a 4.8 percent pay increase for October 1981 and additional workyear requirements.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #3.0

Title: Development

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

- c. Publication of the Defense Technical Information Center 10-Year STINFO Plan, Fiscal Years 1978-87, which contains the findings of the contractual study of future Scientific and Technical Information requirements and technology, internal requirements studies, and other documents containing guidance or recommendations for Defense Technical Information Center's programs, goals, and objectives.
- d. Development of a project to assist DoD laboratories/libraries to gain access to commercial on-line services.
- e. A study of the feasibility and design of a prototype data base service for DTIC users to search specific external data bases to which the requester does not have convenient access.
- f. A study of the feasibility and requirements for implementing new or expanded reference data bases for DTIC users to improve identification of and access to STINFO and RDT&E capabilities and facilities.
- g. Direct assistance to DUSDR&E in developing and obtaining specific improvements to the DoD Technical Information Program and assisting in the experimentation with the implementation of improved electronic information systems and devices to support the DUSDR&E requirements.
- h. Study and analysis of the economics and effectiveness of DTIC indexing and vocabulary control practices, including manual and machine-aided indexing, in contrast to other alternatives for providing on-line search of data bases and remote data base input.
- i. Design of training programs which use improved, cost effective methods of introducing on-line terminal operators to the retrieval process.
- j. Completed feasibility study to examine state-of-the-art and recommend alternatives to hard copy documents.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #3.0

Title: Development

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management Support

3. FY 1983-84 Planned Program:

- a. Identify and assess new or changed requirements, trends, or priorities for the use of technical information or information services; explore methods to characterize and analyze information needs and practices of principal activities and target groups within the information user and generator communities; and develop techniques to expand awareness and use of information resources.
- b. Continue expanding Defense Technical Information Center's role in providing single-point access within DoD to STINFO-related services or resources.
- c. Continue analysis of and experimentation with exploitable new technologies and concepts for information transfer.
- d. Continue investigation of innovative techniques to enhance the scope and effectiveness of DoD document and data base systems and services.
- e. Investigate the technique and equipment for converting technical information, including graphics, to digital bit streams for storage, retrieval, and transmission.
- f. Develop cooperative STI research efforts with two or more military laboratories and fund for the laboratory efforts.
- g. Increased funding requirements are due to additional development type contracts and required increase in workyears to accomplish DTIC's mission.

FY 1983 DESCRIPTIVE SUMMARY

Project #3.0

Title: Development

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

4. Program to Completion:

This is a continuing program.

RESOURCES: (IN THOUSANDS OF DOLLARS)

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RDTE: Funds	655	599	1,061	1,479	Continuing	Not Applicable

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #4.0

Title: Systems Maintenance & Operational Improvements

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

BACKGROUND AND DESCRIPTION: This is a continuing program which provides for the effort associated with applying existing techniques, equipment and technology to operating systems to extend their capabilities or to improve their performance. The purpose of this effort is to provide technical personnel in direct support of the Defense Technical Information Center's Automatic Data Processing Application Systems. Major automatic data processing applications include the Defense Research, Development, Test, and Evaluation On-Line System, Technical Report System (DD 1473), Work Unit Information System (DD 1498), Research and Development Program Planning (DD 1634) System, and the Independent Research and Development System with functional subsystems for input, update, file maintenance, retrieval, announcement/publication, reports generation, inventory, and demand and automatic distribution. Overall Defense Technical Information Center application systems which operate against four Defense Research, Development, Test, and Evaluation data banks and related ancillary/reference files encompass some 15 subsystems and a computer program inventory of over 500 production programs. Included also is the effort to maintain data files and monitor operational readiness and availability of automatic data processing systems, control cryptographic equipment, and monitor the on-line system. In addition, efforts for the tests and assemblies of new or changed procedures or programs are included.

RELATED ACTIVITIES: None.

WORK PERFORMED BY: Effort is performed in-house at the Defense Technical Information Center; however, the Defense Technical Information Center does contract for short-term, one-time efforts for which it would be uneconomical to hire and maintain in-house staff.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

- a. Supported the acquisition and expansion of Information Analysis Center (IAC) data bases.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #4.0

Title: Systems Maintenance & Operational Improvements

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

- b. Implemented a Shared Bibliographic Input Experiment capability of technical report formatted data into the Technical Report System for Defense Research, Development, Test, and Evaluation On-Line System users.
- c. Implemented unclassified dial-up access to optimize the use of the Defense Research, Development, Test and Evaluation On-Line System.
- d. Added a limited text search capability, title searching, and tape cassette output capability to the Defense Research On-Line System (DROLS).
- e. Continued system and programing support for maintenance and other operational improvements of all Defense Technical Information Center automatic data processing applications.
- f. Expanded On-Line System Automatic Data Processing capability consistent with the needs of the Defense Research, Development, Test, and Evaluation On-Line System.
- g. Implemented Defense Research, Development, Test and Evaluation On-Line System interface with a generalized Data Base Management System.
- h. Implemented DTIC Time Sharing Facility (DTSF) which provides remote access to the UNIVAC 1108 system at DTIC for interactive program and data base development.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #4.0

Title: Systems Maintenance & Operational Improvements

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

2. FY 1982 Planned Programs:

- a. Install a Front End Processor to control communications and to free computer core space for other applications.
- b. Install a non-impact printer to increase printing capability and improve customer product.
- c. Continue experimentation of Data Base Management System (DBMS) to develop new access techniques and file structures.
- d. Continue programing of the Information Processing System.
- e. Continue system and programing support for maintenance and other operational improvements of all Defense Technical Information Center's automatic data processing applications.
- f. Increased funding in FY 1982 results primarily from a pro rata share of rents and maintenance for the front end processor and non-impact printer. A 4.8 percent pay increase effective October 1981 has been included in funding.

3. FY 1983 Planned Programs:

- a. Continue system and programing support for maintenance and other operational improvements of all automatic data processing applications.
- b. Continued lease of the front end processor and non-impact printer.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #4.0

Title: Systems Maintenance & Operational Improvements

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

c. Increased funding requirements in FY 1983 are attributable to the purchase of ADPE equipment, planned rental and maintenance of a data concentrator for expansion of DROLS.

4. FY 1984 Planned Programs:

a. Continue system and programing support for maintenance and other operational improvements of all automatic data processing applications.

b. Purchase of replacement cryptographic equipment.

c. Increased funding in FY 1984 results primarily from the planned purchase of replacement cryptographic equipment.

5. PROGRAM TO COMPLETION:

This is a continuing program.

RESOURCES: (IN THOUSANDS OF DOLLARS)

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RDT&E: Funds	2,247	2,372	2,842	3,066	Continuing	Not Applicable

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project #5.0

Title: Management and Support

Program Element 65801S

Title: Defense Technical Information Center

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

BACKGROUND AND DESCRIPTION: This program provides for normal management and support functions of the Center including management operations, administrative equipment and supplies, normal housekeeping services, and technical terminology and central registry functions common to the Defense Technical Information Center's mission.

RELATED ACTIVITIES: None.

WORK PERFORMED BY: Administrative and management operations are performed in-house with the exception of support functions that can be provided on a station-wide basis. These services are provided by the Defense Logistics Agency Administrative Support Center at Cameron Station, Alexandria, Virginia, on a reimbursable or common service basis.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Emphasis will continue to be placed on obtaining administrative support and logistic functions at the most efficient level to accomplish the Defense Technical Information Center's mission. Decreased effort will be expended on the Technical Terminology Program as editing of the Natural Language Data Base terms has been completed. Effort in the Scientific and Technical Information Central Registry will remain at the same level.

The increased funding requirement in FY 1982 versus FY 1981 is attributable to increased costs in communications and a 4.8 percent pay increase effective October 1981.

Increased funding requirement in FY 1983 and FY 1984 over FY 1982 includes contractual support for the Manpower and Training Research Information System (MATRIS).

PROGRAM TO COMPLETION: This is a continuing Program.

RESOURCES: (IN THOUSANDS OF DOLLARS)

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RDT&E: Funds	3,577	3,999	4,787	4,872	Continuing	Not Applicable
568						

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65802S

Title: Information Analysis Centers

Mission Area 610

Budget Activity: #6 Program-wide Management and Support

A. RESOURCES/PROJECT LISTING

(\$ IN THOUSANDS)

Project Number	Title	FY 1981 Program	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimated Cost
1.0	TOTAL FOR PROGRAM ELEMENT	2,982	3,200	5,140	6,535	Continuing	Not Applicable

B. BRIEF DESCRIPTION OF ELEMENT:

This program element provides funding for eleven (11) contractor-operated Information Analysis Centers (IACs). The role of an IAC in national defense is to assure that the Department of Defense (DoD) carries out its mission in a timely and effective manner by serving as a focal point for authoritative expertise and maintaining a national data base within its scope of coverage. IACs serve as a vehicle for effective technology transfer by collecting, storing, reviewing, evaluating, and synthesizing authoritative scientific and technical information in well-defined fields of technology in formats most useful to DoD scientists and engineers.

C. BASIS FOR FY 1983 RDT&E REQUEST:

During FY 1983 the efforts to increase the effectiveness of the centers and enhance their capability to meet identified user needs will be continued. Technical areas of primary emphasis will include carbon-carbon composite materials, metal-matrix materials and applications, and support of the manufacturing technology program. During the year the centers will collectively acquire more than 35,000 new sources of technical information, answer approximately 1,300 technical inquiries, and update, expand, or complete more than 30 handbook/databook volumes. The centers will also complete a variety of state-of-the-art reports, critical reviews, and technology assessments within their specialized area of technology.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65802S

Title: Information Analysis Centers

Mission Area: 610

Budget Activity: #6 Program-wide Management and Support

D. BASIS FOR DATA BASE INCREASE IN 1983 OVER 1982:

One of the nation's problems currently being highlighted is the need to improve the productivity of the nation's industrial base and, particularly, the defense industrial base. During the next five years the DoD Manufacturing Technology Program (MTP) will invest roughly \$1.3+ billion in advanced Manufacturing Technology (MT) needed for the production of DoD weapons systems. In order for DoD and the nation to take fullest advantage of these investments, the output of the MTP products must be conveniently available to the defense industrial base. In support of this need, \$0.4 million was added to support the establishment of the Manufacturing Technology Information Analysis Center. A total of \$0.3 million was added to support the requirement for DTIC to assume responsibility for the management of the Data and Analysis Center for Software (DACS) effective in FY 83. The DACS serves as a central source for current, readily usable data and information concerning software technology. Additionally, during a period of general inflation in the economy, the basic level of funding for IACs has been straight-lined. To prevent further reduction in the component of professional technical analysis in IACs and to enable the IACs to accomplish the requirements imposed by DLA/DTIC in the Statement of Work in current contracts, an inflation clause was added in FY 1983.

E. PERSONNEL IMPACT:

The average number of employees supported with requested FY 1983 RDT&E Funds is as follows:

	<u>RDT&E</u>	<u>Procurement</u>	<u>Total</u>
(1) Federal Civilian Employees	-	-	-
(2) Contractor Employees	121	-	121

F. TERMINATION COST:

	<u>FY 1982 & Prior Funds</u>	<u>FY 1983 Funds</u>	<u>Total</u>
(1) Estimated Government Liability Financed with:	Not Applicable.....	

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #1.0

Program Element: 65802S

Mission Area: 610

Title: Information Analysis Centers

Budget Activity: #6 Program-wide Management and Support

BACKGROUND AND DESCRIPTION: This program element provides funding for the operation of eleven (11) contractor operated Information Analysis Centers. The centers collect, review, and analyze the results of research and development in certain well defined areas of technology. These areas include chemical propulsion, engineering properties of materials, infrared physics, metal matrix composites, reliability data on electronic components, and tactical weapons guidance and control systems. Based on their review and analysis, the scientists and engineers at the centers synthesize, repackage, and disseminate the information in a format most useful to Department of Defense scientists and engineers. The services provided by the centers include responses to inquiries in their fields of special competence; preparation, publication, and updating of engineering reference works; and preparation of special analysis tasks such as state-of-the-art reports, critical reviews, and technological assessments. The products and services of the centers are provided on a service-charge basis to DoD components, contractors and grantees, U.S. Government agencies, and, to the extent practical, the private sector. The income thus obtained is reintroduced into the program for the development of additional products and services. The aim of these services is to improve weapons reliability, engineering decisions, and development lead time and to provide a means of increasing the productivity of defense scientists and engineers through reduction of duplicative test and evaluation programs.

RELATED ACTIVITIES: There are ten (10) other designated DoD centers, managed by other DoD components, which provide similar services within other well defined technical areas such as hydraulic engineering, plastics, soil mechanics, and concrete technologies.

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #1.0

Program Element: 65802S

Mission Area 610

Title: Information Analysis Centers

Budget Activity: #6 Program-wide Management and Support

PROGRAM ACCOMPLISHMENTS & FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: The FY 1981 program emphasized the modification of center scopes, products, and services intended to increase the effectiveness of the centers in meeting the identified priority evaluated information needs of DoD scientists and engineers. The number of documents in the DLA Information Analysis Centers files reached an aggregate of 650,000 records. Significant publications include the Guidance Law Handbook for Classical Proportional Navigation, the Infrared Handbook, the Nondestructive Testing Handbook, the Structural Alloys Handbook, and a new addition of the Machining Data Handbook. Additionally, a new center specializing in information relative to metal-matrix materials was established.
2. FY 1982 Planned Program: The FY 1982 program will be conducted in substantially the same manner as the FY 1981 program with a continuation of modifications intended to enhance the value of the centers to the overall defense RDT&E program and to increase the operating efficiency of the centers. During the year, the centers will acquire approximately 35,000 new sources of technical information, answer approximately 1,200 technical inquiries, and complete and disseminate a variety of handbooks, databooks, state-of-the-art reports, and special studies.
3. FY 1983 Planned Program: During FY 1983 the implementation of required modifications will continue and emphasis will be placed on the development of information identified as priority needs of DoD. DTIC will assume responsibility for the management of the Data and Analysis Center for Software and the Manufacturing Technology Information Analysis Center will be established. Efforts in support of metal-matrix composite materials will be intensified.
4. FY 1984 Planned Program: During FY 1984, the efforts indicated in FY 1983 will be continued.

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE LOGISTICS AGENCY
RESEARCH, DEVELOPMENT, TEST & EVALUATION, DEFENSE AGENCIES
FY 1983 RDT&E DESCRIPTIVE SUMMARY

Project: #1.0

Program Element: 65802S

Mission Area 610

WORK PERFORMED BY: (FY 1982)

Title: Information Analysis Centers

Budget Activity: #6 Program-wide Management and Support

INFORMATION ANALYSIS CENTER

Chemical Propulsion Information Agency
Infrared Information & Analysis Center
Mechanical Properties Data Center
Metals and Ceramics Information Center
Nondestructive Testing Information Analysis Center
Reliability Analysis Center
Tactical Weapon Guidance and Control Information
Analysis Center
Thermophysical & Electronic Properties Information
Analysis Center
Metal-Matrix Composites Information Analysis Center
Manufacturing Technology Information Analysis Center
Data and Analysis Center for Software

CONTRACTOR & CENTER LOCATION

Applied Physics Laboratory, Johns Hopkins University, Laurel, MD
Environmental Research Institute of Michigan, Ann Arbor, MI
Battelle Memorial Institute, Columbus, OH
Battelle Memorial Institute, Columbus, OH
Southwest Research Institute, San Antonio, TX
IIT Research Institute, Rome, NY
IIT Research Institute, Chicago, IL
Purdue University, West Lafayette, IN
Kaman-Tempo, Santa Barbara, CA
To be Determined
Administrative Management in FY 1983

FY 1983 DESCRIPTIVE SUMMARY

Project: #1.0

Program Element: 65802S

Mission Area 610

Title: Information Analysis Centers

Budget Activity: #6 Program-wide Management and Support

5. Program to Completion: This is a continuing program.

RESOURCES: (IN THOUSANDS OF DOLLARS)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>	<u>Additional</u> <u>to</u> <u>Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
Total for Program Element	2,982	3,200	5,140	6,535	Continuing	Not Applicable

Research, Development, Test, and Evaluation, Defense Agencies

NSA

21 JAN 82

Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:

Direct:

- 5. Intelligence and communications
Reimbursable program

10.0001 Total

Financing:

Offsetting collections from:

- 11.0001 Federal funds
- 21.4001 Unobligated balance available, start of year:
- 21.4002 For completion of prior year budget plans
- 21.4002 Reprogramming from or to prior year budget plan
- 24.4001 Unobligated balance available, end of year
- 25.0001 Unobligated balance lapsing

39.0001 Budget authority

Budget authority:

- 40.0001 Appropriation
- 42.0001 Transferred from other accounts
- 43.0001 Appropriation (adjusted)

Research, Development, Test, and Evaluation, Defense Agencies

NSA

21 JAN 82

Object Classification (in thousands of dollars)

Identification code	97-0400-0-1-051	1981 actual	1982 est.	1983 est.
Direct obligations:				
121.001	Travel and transportation of persons			
122.001	Transportation of things			
123.201	Communications, utilities and other rent			
Other services:				
125.003	Contracts			
125.004	Other			
126.001	Supplies and materials			
131.001	Equipment			
141.001	Grants, subsidies, and contributions			
199.001	Total direct obligations			
Reimbursable obligations:				
Other services:				
225.004	Other			
999.901	Total obligations			

NATIONAL SECURITY AGENCY
FY 1983 Budget Estimate
Defense Agencies, RDT&E Program
Summary by Budget Activity
(Dollars in Thousands)

Section 2

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Budget</u>	<u>FY 1984 Authorization</u>
5. <u>Intelligence and Communications</u>				
Total RDT&E-DIRECT				
Reimbursements				
Total PROGRAM				

AD-A611 642

OFFICE OF THE SECRETARY OF DEFENSE WASHINGTON DC
JUSTIFICATION OF ESTIMATES FOR FISCAL YEAR 1983 SUBMITTED TO CO--ETC(U)
FEB 82

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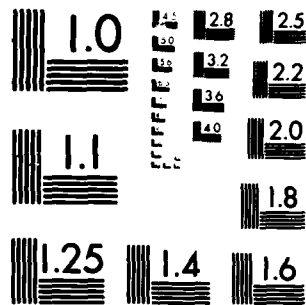
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MICROCOPY RESOLUTION TEST CHART
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NATIONAL SECURITY AGENCY
FY 1983 Budget Estimate
Defense Agencies, RDT&E Program
Summary by Program Category
(Dollars in Thousands)

Section 2

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Budget</u>	<u>FY 1984</u> <u>Authorization</u>
<u>Operational Systems Development</u>				
31011G Cryptologic Activities				
33401G Communications Security				
35885G Tactical Cryptologic Activities				
35167G Computer Security Program				
Total RDT&E-DIRECT				
Reimbursements				
Total PROGRAM				

Research, Development, Test, and Evaluation, Defense Agencies

NSA

21 JAN 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
<hr/>							
Program by activities:							
Direct:							
	5. Intelligence and communications						
	Reimbursable program						
10.0001	Total						
Financing:							
Offsetting collections from:							
11.0001	Adjustment to prior year federal fund orde						
	Unobligated balance available, start of year:						
21.4001	For completion of prior year budget plans						
21.4002	Reprogramming from or to prior year budget plan						
25.0001	Unobligated balance lapsing						
40.0001	Budget authority (appropriation)						

Research, Development, Test, and Evaluation, Defense Agencies

NSA

21 JAN 82

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
5. Intelligence and communications							
Reimbursable program							
10.0001	Total						
Financing:							
Offsetting collections from:							
11.0001	Federal funds						
21.4001	Unobligated balance available, start of year						
24.4001	Unobligated balance available, end of year						
39.0001	Budget authority						
Budget authority:							
40.0001	Appropriation						
42.0001	Transferred from other accounts						
43.0001	Appropriation (adjusted)						

Research, Development, Test, and Evaluation, Defense Agencies

NSA

21 JAN 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	5. Intelligence and communications						
	Reimbursable program						
10.0001	Total						
Financing:							
Offsetting collections from:							
11.0001	Federal funds						
21.4001	Unobligated balance available, start of year						
24.4001	Unobligated balance available, end of year						
39.0001	Budget authority						
Budget authority:							
40.0001	Appropriation						
42.0001	Transferred from other accounts						
43.0001	Appropriation (adjusted)						

Research, Development, Test, and Evaluation, Defense Agencies

NSA

21 JAN 82

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	5.	Intelligence and communications	.....	.....	
		Reimbursable program	.....	.....	
10.0001		Total	.....	.....	
Financing:							
Offsetting collections from:							
11.0001		Federal funds	.....	.....	
24.4001		Unobligated balance available, end of year	.....	.....	
40.0001		Budget authority (appropriation)	.....	.....	

NATIONAL SECURITY AGENCY
PERFORMER DISTRIBUTION
Research, Development, Test and Evaluation
(Dollars in Thousands)

Section 3

APPROPRIATION: RDT&E, Defense Agencies

	Total Obligational Authority			
	FY 1981	FY 1982	FY 1983	FY 1984
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Authorization</u>
1. For operation of installations of the reporting DoD Components Government operated				
2. For operation of installation of the reporting DoD Contractor operated				
3. For contracts <u>directly in support</u> of work actually performed at installations of the reporting DoD Component				
4. For work assigned to other Department of Defense activities				
5. For work assigned to activities of other Government agencies				
6. For work performed by industrial contractors ("profit" organizations)				

Total Obligational Authority			
FY 1981	FY 1982	FY 1983	FY 1984
<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Authorization</u>
7. For work performed by educational institutions			
a. Designated Fed Contracts Res Centers			
b. Other Institutions			
8. For work performed by other "non-profit" organizations			
a. Designated Fed Contracts Res Centers			
b. Other Institutions			
9. Total RDT&E appropriation			

NATIONAL SECURITY AGENCY
DEFENSE AGENCIES, RDT&E

Federal Contract Research Centers (FCRC)
(Dollars in Thousands)

Section 6

FY 1981
Actual

FY 1982
Estimate

FY 1983
Estimate

FY 1984
Authorization

FCRC

DESCRIPTIVE SUMMARIES AND OTHER DETAILS ON NATIONAL SECURITY AGENCY PROGRAMS ARE NOT INCLUDED AS THEY REQUIRE SPECIAL ACCESS. THE ADDITIONAL INFORMATION WILL BE PROVIDED IN THE JUSTIFICATION BOOKS ENTITLED, CONSOLIDATED CRYPTOLOGIC PROGRAM, TACTICAL CRYPTOLOGIC PROGRAM, COMMUNICATIONS SECURITY PROGRAM AND COMPUTER SECURITY PROGRAM AND MORE HIGHLY CLASSIFIED DOCUMENTATION PROVIDED TO EXAMINERS OF THE NSA BUDGET.

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Research, Development, Test, and Evaluation, Defense Agencies

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Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
6.	Defensewide mission support	21,293	20,900	31,800	16,179	21,594	34,904	
	Reimbursable program	167	1,500	1,500	167	1,500	1,500	
10.0001	Total	21,460	22,400	33,300	16,346	23,094	36,404	
Financing:								
Offsetting collections from:								
11.0001	Federal funds	-167	-1,500	-1,500	-167	-1,500	-1,500	
	Unobligated balance available, start of year:							
21.4001	For completion of prior year budget plans				-1,039	-6,020	-5,326	
21.4002	Reprogramming from or to prior year budget plan	-133						
24.4001	Unobligated balance available, end of year				6,020	5,326	2,222	
25.0001	Unobligated balance lapsing	133			133			
40.0001	Budget authority (appropriation)	21,293	20,900	31,800	21,293	20,900	31,800	
Direct obligations:								
121.001	Travel and transportation of persons				33	35	40	
Other services:								
125.003	Contracts				16,146	21,559	34,864	
199.001	Total direct obligations				16,179	21,594	34,904	
Reimbursable obligations:								
Other services:								
225.003	Contracts				167	1,500	1,500	
999.901	Total obligations				16,346	23,094	36,404	

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND ORGANIZATION OF THE JOINT CHIEFS OF STAFF
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

SUMMARY BY BUDGET ACTIVITY
(\$ in Thousands)

	<u>FY1981</u> <u>ACTUAL</u>	<u>FY1982</u> <u>ESTIMATE</u>	<u>FY1983</u> <u>ESTIMATE</u>	<u>FY1984</u> <u>ESTIMATE</u>
6. Programwide Management & Support	21,293	20,900	31,800	34,144
TOTAL RDT&E - Direct	21,293	20,900	31,800	34,144
Reimbursements	167	1,500	1,500	1,500
TOTAL PROGRAM	21,460	22,400	33,300	35,644

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND ORGANIZATION OF THE JOINT CHIEFS OF STAFF
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

SUMMARY BY PROGRAM CATEGORY
(\$ in Thousands)

	<u>FY1981</u> <u>ACTUAL</u>	<u>FY1982</u> <u>ESTIMATE</u>	<u>FY1983</u> <u>ESTIMATE</u>	<u>FY1984</u> <u>ESTIMATE</u>
6.1 Research				
6.2 Exploratory Development				
6.3 Advanced Development				
6.4 Engineering Development				
6.5 Management and Support	21,293	20,900	31,800	34,144
Total Research and Development (Program 6)	21,293	20,900	31,800	34,144
Total Operational Systems Program	-	-	-	-
Total RDT&E - Direct	21,293	20,900	31,800	34,144
Reimbursements	167	1,500	1,500	1,500
TOTAL PROGRAM	21,460	22,400	33,300	35,644

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Research, Development, Test, and Evaluation, Defense Agencies

DASD

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Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
10.0001	Total				906			
Financing:								
Unobligated balance available, start of year:								
21.4001	For completion of prior year budget plans				-1,039			
21.4002	Reprogramming from or to prior year budget plan	-133						
25.0001	Unobligated balance lapsing	133			133			
40.0001	Budget authority (appropriation)							

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
6. Defensewide mission support								
	Reimbursable program	21,293			15,273	6,020		
		187			187			
10.0001	Total	21,460			15,440	6,020		
Financing:								
Offsetting collections from:								
11.0001	Federal funds	-187			-187			
21.4001	Unobligated balance available, start of year					-6,020		
24.4001	Unobligated balance available, end of year				6,020			
40.0001	Budget authority (appropriation)	21,293			21,293			

HESSLER
Hessler

Research, Development, Test, and Evaluation, Defense Agencies

DASD

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Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
	8. Defensewide mission support		20,900			15,574	5,326	
	Reimbursable program		1,500			1,500		
10.0001	Total		22,400			17,074	5,326	
Financing:								
Offsetting collections from:								
11.0001	Federal funds		-1,500			-1,500		
21.4001	Unobligated balance available, start of year						-5,326	
24.4001	Unobligated balance available, end of year					5,326		
40.0001	Budget authority (appropriation)		20,900			20,900		

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations			
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.	
Program by activities:								
Direct:								
	8. Defensewide mission support			31,800			29,578	
	Reimbursable program			1,500			1,500	
10.0001	Total			33,300			31,078	
Financing:								
Offsetting collections from:								
11.0001	Federal funds			-1,500			-1,500	
24.4001	Unobligated balance available, end of year						2,222	
40.0001	Budget authority (appropriation)			31,800			31,800	

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND
ORGANIZATION OF THE JOINT CHIEFS OF STAFF

FY1983 RDT&E, DEFENSE AGENCIES
PERFORMER DISTRIBUTION
(\$ in Thousands)

	<u>FY1981</u> <u>Actual</u>	<u>FY1982</u> <u>Estimate</u>	<u>FY1983</u> <u>Estimate</u>	<u>FY1984</u> <u>Estimate</u>
1. For operation of installations of the reporting developing agency - Government operated	-	-	-	-
2. For operation of installations of the reporting agency - Contractor operated	-	-	-	-
3. For contracts <u>directly in support</u> of work actually performed at installations of the reporting developing agency	-	-	-	-
4. For work assigned to other DoD activities	443	409	550	580
5. For work assigned to activities of other Government agencies	111	210	550	580
6. For work performed by industrial contractors	11,849	10,375	15,868	15,997
7. For work performed by educational institutions				
a. <u>Designated Federal Contract Research Centers</u>	-	-	-	-
b. <u>Other Institutions</u>	526	642	1,235	1,450
8. For work performed by other "non-profit" organizations				
a. <u>Designated Federal Contract Research Center</u>	7,859	8,497	10,471	11,432
b. <u>Other Institutions</u>	505	767	3,126	4,105
9. Total R&D appropriations	21,293	20,900	31,800	34,144

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND
ORGANIZATION OF THE JOINT CHIEFS OF STAFF
FY1983 RDT&E. DEFENSE AGENCIES
Federal Contract Research Center
Summary by Appropriation and Element
(\$ in Thousands)

	<u>FY1981</u> <u>Actual</u>	<u>FY1982</u> <u>Estimate</u>	<u>FY1983</u> <u>Estimate</u>	<u>FY1984</u> <u>Estimate</u>
<u>MITRE</u>				
<u>RDT&E. Defense Agencies</u>				
<u>OUSDR&E/OJCS</u>	315	419	251	300
General Support:				
Manpower, Reserve Affairs and Logistics	<u>55</u>	<u>58</u>	<u>95</u>	<u>112</u>
Total, RDT&E. Defense Agencies	370	477	346	412
<u>O&M. Defense Agencies</u>				
Communications, Command, Control and Intelligence	1,482	2,160	2,256	2,700
Manpower, Reserve Affairs and Logistics	495	517	855	1,008
Health Affairs	309	447	492	-
TRIMIS	<u>1,044</u>	<u>350</u>	<u>541</u>	<u>584</u>
Total, O&M. Defense Agencies	3,330	3,474	4,144	4,292
Total, MITRE	<u>3,700</u>	<u>3,951</u>	<u>4,490</u>	<u>4,704</u>
<u>AEROSPACE CORPORATION</u>				
<u>RDT&E. Defense Agencies</u>				
Net Assessment	115	200	225	270
Total, RDT&E. Defense Agencies	<u>115</u>	<u>200</u>	<u>225</u>	<u>270</u>
Total, AEROSPACE CORPORATION	<u>115</u>	<u>200</u>	<u>225</u>	<u>270</u>
GRAND TOTAL	<u>11,189</u>	<u>11,971</u>	<u>14,615</u>	<u>15,724</u>

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND
ORGANIZATION OF THE JOINT CHIEFS OF STAFF

FY1983 RDT&E, DEFENSE AGENCIES
Federal Contract Research Center

Summary by Appropriation and Element
(\$ in Thousands)

	FY1981 Actual	FY1982 Estimate	FY1983 Estimate	FY1984 Estimate
<u>Institute for Defense Analyses</u>				
<u>RDT&E, Defense Agencies</u>				
Technical Support:				
OUSDR&E/OJCS	6,650	6,590	8,250	9,000
General Support:				
Program Analysis and Evaluation	544	980	1,400	1,450
Manpower, Reserve Affairs and Logistics	180	250	250	300
Total RDT&E, Defense Agencies	7,374	7,820	9,900	10,750
<u>O&M, Defense Agencies</u>				
Communications, Command, Control and Intelligence	-	-	-	-
Total O&M, Defense Agencies	-	-	-	-
Total, IDA	7,374	7,820	9,900	10,750

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND
ORGANIZATION OF THE JOINT CHIEFS OF STAFF

FY1983 RDT&E, DEFENSE AGENCIES
Installation Analysis - FCRCs
(\$ in Thousands)

TOA (\$ in Thousands)										Personnel							
										Professional			Support				
		RDT&E Funds Mgt	Other		All					Paid From Parent Dept	Paid From Other RDT&E	Paid From Other	Paid From Parent Dept	Paid From Other RDT&E	Paid From Other	Mil Pers Asgn'd	Total
FCRC & Location	FY	Bur Etc	Parent Dept	Other DoD	Other Funds	Sub- total	Mil Pers	Total	RDT&E	RDT&E	Other	RDT&E	RDT&E	Other			
Institute for Defense Analyses	1981	-	7,374	-	-	7,374	-	7,374	81	-	-	26	-	-	-	-	107
	1982	-	7,820	-	-	7,820	-	7,820	78	-	-	25	-	-	-	-	103
	1983	-	9,900	-	-	9,900	-	9,900	90	-	-	29	-	-	-	-	119
	1984	-	10,750	-	-	10,750	-	10,750	89	-	-	29	-	-	-	-	118
MITRE	1981	-	370	3,330	-	3,700	-	3,700	4	-	37	1	-	12	-	-	54
	1982	-	477	3,474	-	3,951	-	3,951	4	-	35	2	-	11	-	-	52
	1983	-	346	4,144	-	4,490	-	4,490	3	-	38	1	-	12	-	-	54
	1984	-	412	4,292	-	4,704	-	4,704	3	-	35	1	-	12	-	-	51
Aerospac.	1981	-	115	-	-	115	-	115	1	-	-	1	-	-	-	-	2
	1982	-	200	-	-	200	-	200	2	-	-	1	-	-	-	-	3
	1983	-	225	-	-	225	-	225	2	-	-	1	-	-	-	-	3
	1984	-	270	-	-	270	-	270	2	-	-	1	-	-	-	-	3

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Installation Analysis - FCRCs

TOA (\$ in Thousands)

PERSONNEL 1/

Professional

Support 2/

<u>FCRC & Location</u>	<u>FY</u>	<u>From Parent Dept.</u>	<u>All Other Funds</u>	<u>Total</u>	<u>Paid From Parent Dept. RDT&E</u>	<u>Paid From Other</u>	<u>Paid From Parent Dept. RDT&E</u>	<u>Paid From Other</u>	<u>Total</u>
Institute for Defense Analyses	1981	21,689	500	22,189	203	5	254	6	260
Arlington, Va. and Princeton, N.J.	1982	25,087	500	25,587	209	4	261	5	266
	1983	28,379	500	28,879	218	4	273	5	278
	1984	30,125	500	30,625	215	4	269	5	274

1/ No military personnel are assigned to IDA

2/ Includes Corporate and Division Management and mission support personnel such as guard force, document control, personnel, finance, reproduction, and other administrative services.

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND ORGANIZATION OF THE JOINT CHIEFS OF STAFF
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

PROGRAM ELEMENT LISTING
(\$ in Thousands)

Element Code	Title	<u>FY1981 ACTUAL</u>	<u>FY1982 ESTIMATE</u>	<u>FY1983 ESTIMATE</u>	<u>FY1984 ESTIMATE</u>	<u>DESCRIPTIVE SUMMARY PAGE NUMBER</u>
6.5 MANAGEMENT AND SUPPORT						
65104D	Technical Support to OUSDR&E	11,200	12,100	16,649	19,719	598
65106D	General Support, PA&E	2,205	2,200	3,712	4,294	603
65107D	General Support, Policy/ISA	3,355	2,100	4,419	1,652	606
65108D	General Support, Net Assessment	1,918	1,900	4,006	4,847	612
65109D	General Support, MRA&L	2,615	2,600	3,014	3,632	618
	Grand Total	21,293	20,900	31,800	34,144	

FY 1983 DESCRIPTIVE SUMMARY

Program Element #65104D
Category Management and Support

Title: Technical Support
Budget Activity: #6 Defense Wide Mission Support

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY1981 Actual	FY1982 Estimate	FY1983 Estimate	FY1984 Estimate	Additional to Completion	Total Estimated Costs
	Total for Program Element	11,200	12,100	16,649	19,719	Continuing	Continuing

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Funds technical studies related to research, development, weapon system selection, and defense planning in support of the Office of the Under Secretary of Defense, Research and Engineering (including C³I and AE) and the Organization of the Joint Chiefs of Staff. Studies are utilized to address the myriad of complex issues and dynamic problems facing the Department, both in the long and short run: examining and assessing the implications and consequences of current and alternative policies, plans, operations, strategies and budgets; understanding and gaining insight into the complex multifaceted technological, military, political, and acquisition environment in which future defense decisions and problems will be posed, considered, and made. Studies constitute an essential tool of management. They provide independent and objective analyses and new ideas for supporting the mission of the Department of Defense.

C. BASIS FOR FY 1983 REQUEST: Presently known and predicted defense issues and their impact on defense tactics, long range planning, and future weapon system requirements; key nuclear and chemical weapon issues; Congressionally-mandated program for continued Military Critical Technology List (MCTL) development, the integration of the MCTL into the export control process, including technical support of COCOM negotiations; to identify time phased mixes of C³I systems that satisfy the needs of the weapons systems that they must support; plan and perform mission-oriented evaluations; perform technology assessments; and to identify promising technologies which may ameliorate existing deficiencies; assess

FY 1983 DESCRIPTIVE SUMMARY

Program Element #65104D
Category Management and Support

Title: Technical Support
Budget Activity: #6 Defense Wide Mission Support

alternative military plans programs and requirements; evaluate Defense Acquisition Policy/Strategy and Industrial Preparedness; long range acquisition planning to support defense strategy and policy development.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The FY 1983 program included herein differs from that presented in the FY 1982 Descriptive Summary in that: The FY 1983 program will emphasize architectural planning efforts in the area of strategic connectivity; improve the planning and execution of a mission-oriented evaluation of the C³I weapon systems; develop techniques for improving capabilities to assess and enhance readiness; (focus more strongly on implementation of the MCTL in the export control process); newly emerging systems will be examined on the as-required basis; long range acquisition resource planning will be expanded to address the interrelationship of Defense long range plans with the National Economy and the production/capitalization planning in the defense industrial base.

E. OTHER APPROPRIATION FUNDS: Not applicable to this P.E.

F. DETAILED BACKGROUND AND DESCRIPTION: This program provides studies and analyses support to meet the needs of the Under Secretary of Defense, Research and Engineering, the Organization of the Joint Chiefs of Staff (OJCS). The key objective of the OUSDRE program is to provide detailed analyses, independent assessments and innovative ideas which assist planners and decisionmakers to use our appropriated resources more efficiently and with these resources improve the effectiveness of the deployed military forces. These funds are used to support the USDRE in the exercise of his responsibilities which include: (1) overall responsibility for the defense RDT&E program for acquisition policy; (2) development of an integrated long range strategy for the allocation and use of research, development and procurement resources; (3) maintaining our technological superiority and translating our technologies into deployed military forces; (4) exploiting more fully the technological and industrial strengths of our allies, our own industrial base and our existing military forces and capabilities; (5) improving our understanding of the US/USSR technology balance and the impact of Soviet R&D and acquisition programs on our defense posture; and (6) meeting our export control responsibilities for arms and defense-related technologies.

FY 1983 DESCRIPTIVE SUMMARY

Program Element #65104D
Category Management and Support

Title: Technical Support
Budget Activity: #6 Defense Wide Mission Support

The statutory functions for the Joint Chiefs of Staff require the JCS to prepare plans, policies and doctrine and provide for the direction of operations by the unified and specified commands when directed by the Secretary of Defense. Their specific responsibilities include: (1) serving as the principal military advisers to the President, the NSC and the Secretary of Defense; (2) serving as military staff in the chain of operational command to the unified and specified commands; (3) providing strategic direction of the Armed Forces; (4) reviewing plans, programs and requirements; (5) providing US military representation to international security organizations, mutual defense boards, and commissions; and (6) provide statements of military requirements and strategic guidance for use in the development of budgets, military aid programs, industrial mobilization plans, and research and development programs. The studies and analyses performed for OSD/OJCS provide objective assessments for use in evaluating existing and proposed weapon systems, increasing force effectiveness, improving methods employed in force planning, and estimating the relative standing of selected US, NATO, and Soviet weapons technologies. The types of studies conducted include analytic comparisons of functionally similar weapon systems; analysis of the effectiveness of fire support, close air support and air defense; analysis of command and control systems; and the development of combat models for the support of force planning. The USDRE and the OJCS require such assistance, separate from the Service sponsors, to provide independent and objective basis for the selection of proper courses of action in carrying out their responsibilities.

G. RELATED ACTIVITIES: Other programs contributing to the effort are those studies, analyses, tests and evaluations policy and resource plans, and net assessments performed by the Army, Navy, Air Force, OSD Net Assessment, the Defense Intelligence Agency, other segments of OSD, and the CIA.

H. WORK PERFORMED BY: The Institute for Defense Analyses; RAND Corporation, RDA, MITRE, SAI; BETAC; EG&G; IBM, B-K Dynamics; LMI; the Analytic Science Corporation; System Planning Corporation.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 Program: The following major studies and analyses were performed: Development of a generic Environmental Impact Statement for a nuclear weapon storage facility; evaluation of the potential role of future special nuclear weapon designs in support of US intervention forces; assessment of

FY 1983 DESCRIPTIVE SUMMARY

Program Element #65104D
Category Management and Support

Title: Technical Support
Budget Activity: #6 Defense Wide Mission Support

vulnerability of US/NATO air bases and support facilities; estimates of costs and capabilities of appropriate area air defense systems; analysis of current data and mobilization potential of the US shipbuilding and support industries; development of quantitatively oriented framework for estimating the expected savings from the use of competition early in the production phase of (Army) weapon systems procurement; analysis to resolve specific issues in the effectiveness of air-to-air weapons; revision of the MCTL and implementation of the MCTL in the export control process; development of an integrated plan for integrating sensor, commo and data processing systems for European Theater; evaluation of the operational test program for strategic ballistic missile weapon systems; evaluation of logistic and mobility requirements; evaluation of cost and effectiveness measures for various chemical weapons systems; improve cost estimating for major weapon systems; computed mobilization requirements for Industrial Preparedness Planning; continued assessment of Space Shuttle performance improvement options; cruise missile penetration capabilities.

2. FY 1982 Program: Requirements for studies and analyses include: develop a mission-oriented evaluation of the C3I weapons systems that support the air battle; generate an architectural plan for identifying and evaluating alternative options for C3I support to theater nuclear forces; develop and evaluate alternative space-based systems configurations that would be supportive of hemisphere surveillance requirements and responsive to the needs of tactical commanders, develop indepth, technical support for US positions for upcoming international negotiations for multilateral control of technology and products of Soviet Bloc and continue work for development and implementation of the MCTL; continue assessment of competition as an acquisition strategy in procurement of selected weapon systems; continue analysis of air-to-air missile performance; and integrated anti-air warfare; continue analysis of alternatives to existing basing concepts for US/NATO Tactical Air Forces; investigate reinstitution of the construction of US Navy ships in US shipyards, examine performance and military value of nuclear versus non-nuclear surface combatant ships; evaluate alternative air support forces; examine low cost tactical weapon concepts; identify critical issues in OTH radars for maritime air surveillance; develop systems options for enhancing light divisions; alternatives for Joint Rapid Deployment Force (JRDF) air

FY 1983 DESCRIPTIVE SUMMARY

Program Element #65104D
Category Management and Support

Title: Technical Support
Budget Activity: #6 Defense Wide Mission Support

defense; assess ammunition production base balance and long term requirements study; determine optimized chemical weapon stockpile mix and examine safety, security, and command and control issues associated with chemical weapons; examine advanced command and control issues associated with chemical weapons; examine advanced command and control concepts for nuclear weapons; assess the military utility of a standoff, air delivered, earth penetrator, nuclear weapon system; assess critical material needs related to national security; design and develop a plan to test policies and procedures for mobilization/surging; focus on major acquisition plans; assess Space Shuttle issues and cruise missile survivability; explore emerging technologies on the combat capabilities of future aircraft.

3. FY 1983 and FY 1984 Programs: The anticipated study program will consist of: Studies and analyses comparing the use of long range missiles (S-A, A-A, S-S) with the uses of aircraft with short range weapons; long range surveillance and targeting systems and their capability to provide targeting information for advanced weapon systems; studies and analysis relevant to area air defense problems, as well as studies and analyses in the area of maritime AAW, ASW, strike warfare, defense of CVGB, projection of naval power; create an architectural plan identifying and evaluating options for enhancing connectivity to the strategic forces; initiate the planning and execution of a mission-oriented evaluation of the C³I weapons systems that support the land battle in an integrated battlefield; support air defense modernization efforts by examining technological alternatives in an operational context; proceed with development and implementation of MCTL; improve nuclear accident response planning; examine major issues associated with employment of theater nuclear forces; improve capabilities for crisis management; improve the acquisition process; improve industrial preparedness policy and strategy; focus long range planning to meet future defense needs; examine issues associated with our ability to conduct protracted nuclear war.

4. Program to Completion: The study program is a continuing program.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65106D
DoD Mission Area: Management and Support

Title: General Support - PA&E
Budget Activity: #6 - Defensewide Management and Support

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Additional to Completion	Total Estimate Costs
	TOTAL FOR PROGRAM ELEMENT	\$2,205	\$2,200	\$3,712	\$4,294	Continuing	Continuing

- B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides the contractual costs to support technical studies on behalf of the Office of the Director, Program Analysis and Evaluation.
- C. BASIS FOR FY 1983 RDT&E REQUEST: Funds are required to support technical research and independent studies for use in analyzing and evaluating proposed and alternative defense programs.
- D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Cost Data for FY 1982 reflects projects requiring new or more intensive treatment in FY 1982, and also items that were deferred because of reduced FY 1981 funding. Key examples are the investigation of US defense posture in potential trouble spots, alternative defense measures for management of potential crisis situations, and investigation of causes of cost growth of weapon systems.
- E. OTHER APPROPRIATION FUNDS: None.
- F. DETAILED BACKGROUND AND DESCRIPTION: These technical research studies are aimed at problem areas of DoD force planning and major force-oriented programs. The thrust of this research program is to serve one or more of the following key purposes: (1) develop new and improved methodologies to be used in evaluating alternative defense programs, force structures, and weapon systems acquisition; (2) examine critical technical problems across Service lines; (3) obtain independent and objective appraisals of critical problems; and/or (4) obtain technical expertise not available within DoD.
- G. RELATED ACTIVITIES: Other programs related in part to this effort are technical studies by the Under Secretary of Defense for Research and Engineering, Defense Advanced Research Projects Agency, Defense Nuclear Agency, and the Army, Navy and Air Force

Program Element: #65106D
DoD Mission Area: Management and Support

Title: General Support - PA&E
Budget Activity: #6 - Defensewide Management and Support

H. WORK PERFORMED BY: This work is managed by the Office of the Director, Program Analysis and Evaluation. Current contractors include the Analytical Sciences Corporation, Arlington, Virginia; Institute for Defense Analyses, Arlington, Virginia; Rand Corporation, Santa Monica, California; General Research Corporation, McLean, Virginia; Information Spectrum, Inc., Arlington, Virginia; Operations Research, Inc., Silver Spring, Maryland; Ramcor, Inc., Vienna, Virginia; Science Applications, Inc., Littleton, Colorado; Systems Planning Corporation, Arlington, Virginia; Tecolote Research, Inc., Santa Barbara, California; BDM, McLean, Virginia; Systems Research and Applications Corporation, Arlington, Virginia; TRW, Inc., McLean, Virginia; and Northrop, Hawthorne, California. Formal selections have not been made on competitive efforts.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Prior studies have produced better data and methodology for analyzing and evaluating alternative Defense programs and resource allocations. Specific past accomplishments include technical studies of weapons effectiveness and capabilities; development of guidelines on parametric cost estimating relationships for new weapon systems for use by Service cost organizations; independent analyses of life cycle cost estimates for proposed systems; development of methodology to evaluate strategic force program alternatives; evaluation of the survivability of forces; the modification and application of mathematical models for examining the deployment of US forces in various scenarios; development of comparable performance data for US, USSR, and free world foreign combat aircraft; development of models to estimate the reinforcement capability of Warsaw Pact forces; and analyses of comparative force balances.

2. FY 1982 Program: The FY 1982 program continues the emphasis for improved understanding, data and methodologies for analyzing and evaluating technical issues and alternative defense programs. Research and studies are being conducted of alternative strategic force postures and improved strategic communications. Research is continuing to develop improved methodology for estimating the cost of proposed weapon systems and to provide independent analyses of cost estimates. Studies are being made of alternative force deployments and programs in foreign areas including particularly the readiness and vulnerability of forces. Studies are also underway to examine alternative general purpose force structures in the areas of land, naval, tactical air and mobility.

3. FY 1983 Planned Program: The planned program for FY 1983 reflects the increasing demand for independent technical research, studies and advice on complex and controversial programs. Research studies are planned of strategic and space defense programs including alternative means of supporting US forces and comparisons of the utility and cost of the alternatives. Research will be conducted to develop better methods and data for estimating production costs at a lower level of aggregation than airframe (i.e., wings, stabilizers, etc.). Independent analyses will be obtained of proposed new weapon systems. Research is planned for unique problems that affect defense program costs such as examining the indirect costs of weapon systems,

Program Element: #65106D
Dod Mission Area: Management and Support

Title: General Support - PA&E
Budget Activity: #6 - Defensewide Management and Support

including why dramatic growth has occurred, how different companies define these costs, and ultimately, what can be done about this cost growth. Independent research and studies will be made of alternative force mixes and the readiness of forces in foreign areas. In the area of general purpose forces, research will be conducted to develop better methods to evaluate alternative force structures and weapon system effectiveness and to compare alternate weapon systems.

4. FY 1984 Planned Program: The FY 1984 program will continue the emphasis on developing better understanding, data and methodologies for use in analyzing and evaluating alternative force structure, weapons acquisition programs, and resource allocation. Specific projects are not yet identified, but the program will give emphasis to technical issues and program issues which will become critical for decision at that point in time.

5. Program to Completion: This is a continuing program to improve the technical and analytical base and methods used in the analysis and evaluation of alternative defense programs and weapon systems.

FY 1983 DESCRIPTIVE SUMMARY

Program Element: #65107D
Category: Management and Support

Title: General Support-Policy
Budget Activity: #6 Programwide Management and Support

A. RESOURCES (Project Listing): (\$ in Thousands)

Project Number	Under Secretary of Defense (Policy)	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate	Add'l to Completion	Total Est. Costs
	Total For Program Element	3,355	2,100	4,419	1,652	Continuing	Continuing

B. BRIEF DESCRIPTION OF ELEMENT: The Funds provided to this program element support military interdepartmental and contract policy research projects on national security issues under the cognizance of the Under Secretary of Defense (Policy). Analytical requirements of all Policy components except the Director, Net Assessment, are included in this request.

C. BASIS FOR FY 1983 RDT&E REQUEST: This consolidated request is intended to provide the Under Secretary of Defense (Policy), the Assistant Secretary (International Security Policy), the Assistant Secretary (International Security Affairs) and subsidiary staff components with independent, expert analysis of policy options associated with defense renewal programs. The request is based on a research agenda reflecting the USD(P)'s priority concerns: improvements to US defense posture with respect to Soviet strategic and conventional threats, correlation of US forces, policy, and strategy, enhanced security measures to assure continuing access to oil and other strategic materials, strengthening of NATO political cohesion and commitment to force improvements, and revitalization of regional collective security capabilities and commitments. In each area, research funded under the program provides analytical capabilities only when DoD or other USC staff capabilities are inadequate. Research is obtained from the war colleges, public and private universities, research institutes, and firms whose perspectives may differ from those of DoD, thus providing a wide range of inputs to policy development. This research supplements rather than replaces in-house analysis. This request does not include personal services consulting.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The FY 1983 program is intended to continue support at the FY 1981 actual and 1982 requested level of effort, (4.114 m), adjusted for inflation. Level constant dollar requirements reflect the need for ongoing support to multi-year research programs associated with the Department's effort to (1) align policy and strategy with the actual strategic and conventional power projection capabilities of US forces in the near-term, and (2) link medium- to longer-term force enhancements directly to the projected threat environment. This task is acknowledged to be a massive under-taking in terms of personnel and hardware program commitments. The Policy study effort for FY 1982

and FY 1983 represents a modest collateral investment in overall resource planning, based on (1) improved assessments of the international politico-military environment, and (2) development of associated policy initiatives. Due to reduced appropriations in FY 1982, it has been necessary to defer planned incremental payments and stretch out multi-year programs. Full funding in FY 1983 is required to prevent mid-stream cancellation of major studies.

E. OTHER APPROPRIATION FUNDS: None.

F. DETAILED BACKGROUND DESCRIPTION: The FY 1983 Policy Research program has been developed on the basis of: (a) carryover requirements resulting from the FY 82 funding shortfall, (b) an assessment of new and continuing research requirements, (c) evaluation of available staff assets, results from prior year programs and work sponsored by other agencies and (d) a desire to support a balanced and responsive program that supplements basic research on future policy directions with analytical support for anticipated national security policy decision points. The program continues to stress interdisciplinary study efforts, developing new information, articulating varied perceptions of defense issues and options, and evaluating differing policy options. Management of the program is subject to USD(Policy) review and approval, and is guided by the following criteria:

- Validated utility of anticipated findings for the policy development requirements of the staff component requesting the study,
- Demonstrated relevance of research to the overall mission of the Office of the Under Secretary (Policy),
- Anticipated contribution of research results to effective forecasting of security requirements,
- Technical feasibility, including access to required information sources,
- Priority of subject matter,
- Non-availability of research from other sources, including staff analysis,
- Propriety of DoD sponsorship (as opposed to sponsorship by other agencies),
- Economy and efficiency of research approach, and
- Prospects for economies and efficiencies elsewhere in DoD as a result of studies conducted under the USD(P) program.

G. RELATED ACTIVITIES: The Policy Research program is developed with an awareness of the results of, and plans for, relevant politico-military analyses performed by other DoD elements, e.g., OSD Net Assessment, OASD(PA&E), OJCS and the military services, as well as studies of the State Department, CIA, Energy Department, ACDA, and non-government scholars. OUSD (Policy) co-funds research with other government agencies where a mutuality of substantive interest provides the opportunity to achieve additional economy and efficiency. To strengthen coordination of research planning and management in the politico-military area, OUSD (Policy) continues to participate actively in appropriate inter-departmental working groups and provides a single point of independent review for research requirements

identified by sub-components. This process prevents duplication of effort within the Policy Research program and permits centralized prioritization of study requests generated at staff level.

H. WORK PERFORMED BY: The FY 1983 program is planned to be performed by a variety of organizations including academic study centers, commercial analytical organizations, not-for-profit organizations, Federal Contract Research Centers, and selected DoD elements having research capabilities relevant to OUSD (Policy) needs. Research organizations presently performing studies and potential organizations representing the range available for selection in FY 1983 include: the Rand Corporation, General Research Corporation, BDM Corporation, System Planning Corporation, Stanford University, SRI International, the National Defense University, US Military Academy, R&D Associates, and others. Once a project contractor is selected, a close working relationship is established between DoD staff personnel concerned with the results of the research and the contractor's technical staff. Senior DoD personnel (including the Under Secretary for Policy) participate directly in study task development and approval, in-process review, and the final evaluation and utilization of research results.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1982 and Prior Accomplishments: Recent policy studies reflect a change in USD(P) philosophy concerning the types of projects to which research resources may be best applied. Previously, a number of Policy studies had a general, academic flavor, and addressed international issues of concern to DoD and other agencies. Although such studies broaden the perspective of decisionmakers, it is often difficult to identify the specific utility of findings with respect to more parochial defense concerns. Beginning in FY 1981, and continuing in FY 1982 research program development, we have devoted an increasing share of our resources to (a) integrated analysis of politico/economic/military questions, and (b) shorter studies (both in terms of time to prepare and length of product), focusing on nearer-term (but not operational) questions. A preliminary assessment indicates that study pay-offs have become more identifiable. Notable pay-offs include: better criteria for identification of ambiguous warning indicators of Soviet bloc readiness changes, development of a technical data base for defense and repair of crude oil facilities, initiatives for improving crisis management procedures in NATO, improved methods for assessing the combat effects of RSI variables, tighter controls on transfers of military-significant technologies to the Soviet Bloc, and better evaluation of the economic consequences of transfers of resources to defense.

2. FY 1983 Planned Program: The program of studies proposed for FY 1983 represents a prioritized selection of presently identified external research requirements for OUSD(P) components exclusive of Net Assessment. The thrust of the program will be to create the analytical tools needed to insure long-term correlation between programs and policy. A description of studies now planned for FY 83, as well as continuing FY 81-82 projects requiring incremental funding, is as follows:

Project Description/Contractor

	Actual (Thousands) FY 81 Program*	Planned (Thousands) FY 82 Program	Proposed (Thousands) FY 83 Program
1. <u>Projects Completed (Total)</u>	3,355	2,100	4,419
2. <u>Continuing Projects</u>			
	FY 81	FY 82	FY 83
a. NATO Management: Peace-to-Crisis Transition (RAND)	50	25	
b. NATO Burdensharing (USMA)	7	7	7
c. Future Political Alliances in the Caribbean (TBS)	20	20	20
d. Alternate Procedures for Technology Assessment (DSC)	30	50	
e. RSI Contribution to Combat Effectiveness (BIM)	30	30	30
f. East Asia (USAF)	8	8	8
g. Impact of NATO and US Reindustrialization on Mobilization (TBS)	22	24	
h. Integrated Long-term Defense Strategy (Pan Heuristics/RDA)	243	600	900
i. Analysis of the 9th Polish Party Congress (RAND)	20	20	
j. Recurrent Ambiguous Signals in Europe and Repeatable NATO Responses (RDA)	40	24	
k. Inhibiting the Growth of the Soviet Military-Industrial Base (MRC)	26	50	
l. Expanded US-Japanese Security for the 1980's (SRI)	32	24	
m. DoD Cost Saving Study (Competitive Award)	100	50	
n. Energy Trade, Technology Transfers, and East-West Relations (J. Cooper Assoc.)	50	50	30
o. Strategic Policy Research (RAND)	250	750	1,000
p. C3 Policy Issues (TBD)	100	45	
q. Content Analysis of Soviet Declaratory Policy on Arms Control (Soviet Watch Study) (Quantitative Validation of Soviet Behavior Study, 1980) (AIS)	32	118	150
r. Forecasting the Political Orientation of Less Developed Countries (TBS)	50	75	
s. Implications for the RDF of an Expanded NATO Role Outside the Central Front (TBS)	150	100	
t. Plan for Industrial Mobilization Exercise (Competitive Award)	30	30	

*(Projects will not total FY 81 program because only those FY 81 projects requiring FY 82 or FY 83 funding are listed)

3. New Projects for FY 1982

a. Space Defense/Offense (TBS)	110	
b. Military Governments in the Southern Cone of South America (Hoover Institution)	18	
c. US-Norway Bilateral Study (Phase II) (SPC)	40	40
d. Critical African Issues Workshop (TBS)	30	50
e. Feasibility of Sea-level Panama Canal (Competitive Award)	20	

4. New Projects for FY 1983

a. Economic and Financial Vulnerabilities of Key LDCs (TBS)	70	
b. Impact of Various Energy Disruption Contingencies on national and Global Security (TBS)	160	
c. Framework for Assessment of Naval Confidence Building Measures (SPA)	25	
d. Mobilization Issues Affecting US Reinforcement of NATO and other Deployment Contingencies (TBS)	150	
e. Arab-Israeli Balance Assessment: A Mission Specific Approach (RAND)	50	
f. Soviet Energy and East West Trade (TBS)	88	
g. Projected Defense Budgets of Key LDCs (TBS)	90	
h. Lebanon: Disarmament and Reintegration into Normal Society of the Militias (TBS)	60	
i. Muslim Impact in East Asia (TBS)	120	
j. US Policy on Technology Transfers (TBS)	110	
k. Arms Exports Industrial Structure and Capacity, Phase II (GRC)	50	
l. Philippine Base Renegotiations (TBS)	120	
m. Economic Competition with the USSR (TBS)	22	
n. Changing Impact of Persian Gulf Oil Exporting States on the Economic, Political, and Military Posture of Other Regional States (TBS)	60	
o. US Defense Facilities in Australia (TBS)	22	
p. Economic Mobilization (TBS)	60	
q. Potential Security Challenges to the US and its Allies in Micronesia (TBS)	60	
r. Prospects for Japan/Korea Defense Cooperation (TBS)	60	

s. Framework for Rationalization of Security Assistance (TBS)	250
t. Analysis of Soviet Desant Doctrine & Tactics (C&L)	75
u. Correlation of Forces in Korea (C&L)	50
v. US/NATO LRINF and Flexible Response (USC)	100
w. Resource Transfers to Defense in Times of Emergency (Stanford U.)	8
x. International Economic/Energy sector Initiatives (TBS)	225
y. Space Policy for the Shuttle era (TBS)	110
z. Policy Considerations in Industrial Mobilization (TBS)	69

5. FY 1984 Planned Program: The FY 1984 program is expected to require funding at a level similar to that established for FY 83. Level constant dollar funding during the period assumes a continued requirement for politico-military analysis with no increase in staff analytical capability. If the FY 1982 and FY 1983 programs develop as anticipated, the FY 1984 program will concentrate study resources in topical areas identified above. The Policy Study Program in part anticipates and in part responds to politico-military developments. To the extent allowed by stabilization of international regimes, we will attempt to reduce funding requirements for studies that respond to international developments.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65108D
DOD Mission Area: _____

Title: General Support to Net Assessment (OSD/NA)
Budget Activity: #6 Programwide Management and Support

A. RESOURCES: (PROJECT LISTING) (\$ IN THOUSANDS)

Project Number	Title	FY 1981 Actual	FY 1982 Estimated	FY 1983 Estimated	FY 1984 Estimated	Additional to Completion Continuing	Total Estimated Cost Continuing
	TOTAL NET ASSESSMENT	1,918	1,900	4,006	4,847		

B. BRIEF DESCRIPTION OF ELEMENT: This element provides contractual support for net assessments (OSD/NA) or for studies to support assessments of military balances done for the Secretary of Defense to respond to his concerns about the balances, and to improve Net Assessment methodology.

C. BASIS FOR FY 1983 RDT&E REQUEST: Provide for research and studies to support the determination of the military balance of the U.S. relative to potential adversaries and to aid in formulating appropriate defense issues, decisions, and policies. This program also supports the development of new methods and approaches to Net Assessment within DOD. The estimate recognizes the increasing demand for net assessment by the Executive Branch and the Congress, provides for development of improved methodologies for OSD/JCS and Service net assessments, and responds to net assessment related issues. Four balance areas are focused upon currently to provide net assessments for the Secretary of Defense.

D. COMPARISON WITH FY 82 DESCRIPTIVE SUMMARY: This descriptive summary continues the basic 1981 research program. Emphasis continues on research which will improve net assessments and the methodology to do them. The focus of the FY 83 Net Assessment program will continue to be on the East Asia Balance, Military Balance in Europe, Military Investment Balance, Strategic Balance and some regional balances. It also continues to recognize and is designed to satisfy some of the increasing demand for comparative analyses of particular balance areas within DOD, the Executive Branch and Congress. A major addition to the FY 83 program is support for the Joint DOD/DCI Net Assessments being prepared at the Secretary's direction. Emphasis has been given in paragraph I below to the explanation and description of results of past research. However, it is clear that the research in this program is often analagous to basic research and, therefore, is not ameanable to evaluation as an aid to current decisions, actions, policies and management issues.

E. OTHER APPROPRIATION FUNDS: None. Other organizations co-sponsor or participate in research projects with OSD/NA. This increases overall benefit of specific research projects to DOD.

Program Element: #65108D
DOD Mission Area: _____

Title: General Support to Net Assessment (N/A)
Budget Activity: #6 Programwide Management and Support

F. DETAILED BACKGROUND AND DESCRIPTION: This program supports OSD/NA in providing systematic net assessments (N/A) of aspects of the military balance for the Secretary of Defense. Net assessment is an analytical approach which emphasizes comparison of relevant aspects of overall military, economic and political power/capabilities of different nations. Measures of force effectiveness which include qualitative factors such as training, maintenance and logistics practices, tactical doctrine, organizational flexibility, strategy, geography, etc., are required where possible. Likely outcomes of conflicts are investigated and trends over time analyzed. Net assessments are done at different levels of the U.S. Government for decisionmakers with different levels and scope of responsibility and, therefore, unique perspectives. Within OSD, proprietary net assessments are conducted for the SecDef to shed light on major trends in military balances, so as to discover emerging problems or opportunities. Assessing the strengths, weaknesses and vulnerabilities of each side is a major output of net assessments. It is a natural adjunct to thoughtful, executive-level management. It is a diagnostic device tailored to assist the policy maker in dealing with problems which affect the character and success of the total enterprise. The OSD/NA analyses provide the Secretary of Defense with descriptions and diagnoses of problem areas or opportunities to assist him in utilizing existing, and allocating new, DOD resources more effectively and efficiently to better accomplish our national security goals. Additionally, deficiencies and uncertainties in intelligence or friendly forces information and analysis are documented for appropriate action. Improvements in net assessment methodology and analysis are needed because there are major topics which are not analyzed well now. In particular, we need better comparisons of the likely performance of military organizations as affected by strategy, quality of manning, leadership training, logistics, C³ and tactical doctrine. Readiness and personnel skill levels are not incorporated very well. Assessments do not include the full range of likely contingencies and initial conditions of conflict. Better descriptions of the plausible scenarios against which we should test our policies and forces are required. Analytical capabilities do not allow appropriate testing of policy and force alternatives. Ways of integrating existing military judgements needs to be improved. A substantial and long-term effort is required to improve our capability to do first rate net assessments.

G. RELATED ACTIVITIES: Other programs contributing to this effort are net assessments and supporting studies being performed by the Services and other elements in OSD and DOD. There are also supporting efforts by the intelligence community to provide quantitative and qualitative data concerning foreign military forces; economic, political and technical posture; and other related national resources. Elements of OSD and the Services provide comparable U.S. military posture data. Finally, complementary efforts by other executive branch agencies are used. All of these inputs and the results of this contractual support are integrated into the net assessments as appropriate and provided to the SecDef. The results of OSD/NA research efforts are also used by other organizations and activities within DOD and the U.S. Government.

Program Element: #65108D
DOD Mission Area: _____

Title: General Support to Net Assessment (N/A)
Budget Activity: #6 Programwide Management and Support

H. WORK PERFORMED BY: This research program is managed by the Director, Net Assessment, OSD. Current contractors include: Rand Corporation, BDM Corporation, Research and Development Associates (RDA), Hudson Institute, Boeing Aerospace Company, C&L Associates, System Planning Corporation (SPC), Naval Postgraduate School, The Analytical Sciences Corporation, Analytical Assessments Corporation, MITRE, Advance International Studies Institute, Brookings Institute, SRI International, Harvard (Kennedy School of Government), Carnegie Mellon University and Yale University.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: All OSD/NA research is selected and executed to support the net assessments being prepared for the Secretary of Defense. Sometimes the result of research for one particular fiscal year is integrated into military balances for the following several years. Once the research is used or considered in a net assessment, it completely pays for itself. However, the total research budget also provides more general payoffs. Analyses initiated in FY 75 of the Middle East War of 1973 compared the performance of U.S. and Soviet weapons systems. Results of that research continue to impact DOD comparative analyses and inform decisions being made. Research started in FY 76 focused on U.S. and Soviet long-term competition (R&D and technology) and factors affecting the strategic balance. The findings concerning the competition are being included in the 1982 Defense Guidance. A multiyear assessment of the ability of the U.S. and USSR to project power was started in FY 77. Results were included in the Power Projection Balance prepared for the SecDef in October 1979. This net assessment had an affect upon the development of the Rapid Deployment Joint Task Force, agreements about overseas basing rights and R&D thrusts. Research started in FY 78 focused on estimating the size of the USSR defense program and comparing the economics of U.S. and USSR defense program. Significant results from this and follow-on research were provided in FY 80, 81 and 82 to Congress during testimony by the SecDef, and various DOD witnesses. Research into long-term strategy development and defense policy guidance prompted and aided the creation of organizations in OSD, Navy and Air Force to specifically deal with strategic planning and policy development. Research to identify the basic and changed perceptions of the military balances over the past three years have had implications for U.S. defense policy. U.S. policies with other countries have, therefore, changed. Studies to analyze the U.S./USSR and the NATO/Warsaw Pact military force balance in Europe were primary parts of the FY 79-81 research program. These resulted in valuable guidance for the LTDP, as well as meeting the primary objective of providing necessary inputs for the Military Balance in Europe. Other recent research and their spillover impact include:

- Ways to compare Command, Control Communications & Intelligence systems: USD(RE), DCA, and JCS have adopted some results in the C3I assessments.
- Technology absorption capability of military forces: ASD(ISA), USD(RE) and DSAA have made policy decisions based on this.
- Impact of the changing ethnic composition of the 18 year old cohort on Soviet military: SecDef and others have focused on such Soviet vulnerabilities.

Program Element: #65108D
DOD Mission Area: _____

Title: General Support to Net Assessment (N/A)
Budget Activity: #6 Programwide Management and Support

These assessments and studies have served as bases for better net assessments for the top DOD decisionmakers, improving net assessment methodology throughout DOD, as well as identifying the issues considered by and shaping the policies and decisions of the Secretary of Defense.

2. FY 1982 Program; Studies that address the relative efficiencies and effectiveness of the U.S. and USSR in military competition throughout the overall military balance will be a high item of interest. This will include analysis of the historical trends, projections and related implications. Research will continue into the long-term U.S./USSR competition, implications of the differences in U.S./USSR military doctrines, and the nature of the strategic, East Asia, investment and NATO/Warsaw Pact balances. Some of the specific topics to be researched include:

Military Balance in Europe \$500,000

- Complete the extension of the US/Soviet conventional ground forces maturing threat.
- Validate and demonstrate the value of the composite assessment methodology (corps sector analysis).
- Continue to investigate Soviet views of the military balance in Europe.
- Initiate work to conceptualize how the Southern Flank can be integrated into the balance.
- Develop alternate views of alliance cohesion under a variety of scenarios.

East Asia \$300,000

- Complete the evaluation of the North Korean economic ability to continue to sustain the current level of military effort.
- Investigate Soviet vulnerabilities in the Far East.
- Explore plausible Japanese views of the Military balance in East Asia as seen by the Japanese.
- Understand the evolution and future direction of the Japanese military organization.

Military Investment \$500,000

- Soviet Military Institutions and Manpower Problems.
- Expand research on mobilization capabilities--Ability to Sustain or Surge Size of Military Efforts of U.S. and Soviet Union.
- Develop Force Modernization Comparison Algorithms useful for all forces.
- Improve methodology to analyze Soviet economy and potential defense expenditures.

Power Projection \$100,000

- Comparative Tactics, C³I, training and logistics of light forces.

Program Element: #65108D
DOD Mission Area: _____

Title: General Support to Net Assessment (N/A)
Budget Activity: #6 Programwide Management and Support

Southern Flank/Middle East/Persian Gulf

\$100,000

- Investigate plausible alternate U.S. actions to enhance usefulness of Third country contributions to help us attain our objectives.
- Design alternative concepts for treating the Southern Flank countries and integrating them into the Military Balance in Europe.

Competition and Soviet Views

\$200,000

- Soviet views and uses of operation of institutes focused on U.S. and Canada.
- Soviet assessment of China and strategy with respect to it.
- Cost of maintaining the Soviet empire.

Net Assessment Improvements

\$200,000

- Organizational theory approach to assessment of C³I capabilities and vulnerabilities.

OTHER

3. FY 1983 and 1984 Planned Program: The future OSD/Net Assessment contract studies program objectives remain: (1) research leading to better assessments of the military balance, and (2) research on improved net assessment methods. The analytic studies and comparisons will build on promising previous work and focus on the Strategic, NATO/WP, Military Investment, and East Asia balances. Some research will continue to be focused on the evolving balances concerning Middle East, Africa South of the Sahara, Power Projection and Maritime. Studies will continue to assess the impact of the man/weapon combination, technology transfer, and relevant doctrinal issues of the U.S./USSR competition. Other studies to improve balances and methods will focus on: Soviet views and assessments of various Military Balances, scenarios for improved assessments, doctrinal asymmetries, etc. To these ends, we would plan to fund such research as:

- Ongoing Balance Development Research: European net assessment study; further development of U.S./USSR studies on comparative doctrine/capabilities; identification of comparative abilities to absorb and exploit technology; description of maturing Soviet technology and technological management, integration of Southern Flank.
- Soviet Views of the Balances: Improve understanding of how the Soviets assess the balances, what scenarios they think are important, and what criteria they may use in making their own assessments and decisions.
- Improved Scenarios for Assessment: Develop a broader range of more realistic scenarios for strategic nuclear conflict, NATO/Warsaw Pact hostilities, and crisis and conflict in other regions of the world. Examine plausible crisis and conflict initiation scenarios. Consider changes in the world and the way crisis and conflict might evolve.

Program Element: #65108D
DOD Mission Area: _____

Title: General Support to Net Assessment (N/A)
Budget Activity: #6 Programwide Management and Support

- Doctrinal Asymmetries: Investigate comparative evolution and current status of doctrine, tactics and operations; of ground/Air Forces, transition from peace to crisis, tactical nuclear weapons and CBR warfare doctrine/tactics.
- Manpower/Organization-related Issues: Compare relative force sizes, training and personnel practices, demographic constraints, leadership development, and organizational effectiveness over time.
- Comparative Economics: Develop better methods for analyzing: U.S./USSR defense budgets, military burden impact, production capacity, mobilization/surge issues, force modernization, and additivity of Allied budgets.
- General Net Assessment Improvement: Determine and study key components and essential characteristics of military competition and criteria for evaluating success; look into past assessments by military competitors; analyze military developments and trends; estimate future opportunities and risks in the military competition; appraise strengths, weaknesses, competences, advantages, and vulnerabilities of U.S./USSR and other forces against one another and in the changing competitive environment.

4. Program to Completion: This is a continuing analytic program to directly support the Secretary of Defense and improvement of Net Assessments in the Department of Defense.

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65109b
DCL Mission Area: Management and Support

Title: General Support & Manpower, Reserve Affairs, and Logistics
Budget Activity: #6 Defense-wide Mission & Support

A. RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Authorization	Additional to Completion	Total Estimated Costs
Total for Program Element		\$2,615	\$2,600	\$3,014	\$3,632	Continuing	Continuing

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides resources to support studies of a general nature in manpower, personnel, and logistics research.

C. BASIS FOR FY 82 RDT&E REQUEST: Funds are required to provide independent studies used in addressing high priority problems and issues of DOD military (Active and Reserve), civilian manpower requirements, management and utilization, and logistics management operations to meet force effectiveness and combat readiness goals.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: Provided that our FY 82 appropriation meets the level of funding requested, we should be able to meet the majority of our FY 83 research and studies requirements with the requested funding levels shown above.

E. OTHER APPROPRIATION FUNDS: None.

F. DETAILED BACKGROUND AND DESCRIPTION: These research studies for the Assistant Secretary (Manpower, Reserve Affairs, and Logistics) are directed at high priority problem areas of DOD military and civilian personnel requirements, management utilization, and logistics. The objective of these studies is to provide increased capability of personnel and logistics management operations to meet force effectiveness and combat goals. Inherent to this objective is the necessity to provide data concepts in support of management policy development, to improve the determination of the requirements for manpower, to improve the technological capability of personnel systems to acquire, distribute, train, and utilize qualified personnel from all manpower sources, to develop analytical tools to better address MRA&L issues, to quantify the relationship between military service related factors and job performance, and to provide improved logistics support. These studies, which are primarily applied to OSD policy formulation, also have direct utility to the four Military Services and are integrated with them so that the services and the OSD programs do not duplicate each other. During the FY 78-81 time period, this program has assisted considerably in meeting Congressional and DOD goals of having common DOD-wide problems dealt with on a central coordinated basis.

G. RELATED ACTIVITIES: Other programs contributing in part to this effort are: (1) Personnel Utilization Technology, P.E. 62703F; (2) Army Personnel and Manpower Technology, P.E. 62717A; (3) Naval Personnel Support Technology, P.E. 62763N; (4) Army Training Technology, P.E. 62722A; (5) Navy Manpower Control Systems Development, P.E. 63707N; (6) Military Personnel Performance Development, P.E. 63731A; and (7) Army Contemporary Issues, P.E. 63744A.

H. WORK PERFORMED BY: Work is performed by private non-profit and for profit contractors, federal contract research centers and in-house research centers. Current contractors include General Research Corporation, GE Tempco, Linton and Company, Ray Associates, LaBrie Associates, Operations Research Incorporated, MATHTECH, Human Resources Research Organization, PResearch, Incorporated, Institute for Defense Analyses, and Rand Corporation.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments: Previous efforts have had substantial impact and value by both producing better data and improving the methods for analyzing and evaluating the effects of existing as well as alternative programs and policies. Specific examples from the FY 1981 program include: (1) A study dealing with the optimum use of the Army training base during the first six months of mobilization used as a framework for evaluating the training base during Exercise PROUD SPIRIT and resulting in a remedial action plan for correcting deficiencies; (2) Development of a test plan to identify strengths and weaknesses of DOD and Selective Service System plans for processing volunteers and inductees during mobilization; (3) A study of DOD/Federal Emergency Management Agency interface that provides a coherent baseline of the numerous and complex linkages allowing each affected agency to conduct emergency actions through established processes; (4) Development of the Wartime Manpower Program System which established policies and procedures for determining, documenting, and providing Congress with a SecDef approved statement of wartime time-phased military manpower availability objectives and a peacetime pretrained military manpower inventory objectives; (5) A look at the concomitants of attrition in the National Guard Reserves that was instrumental in developing and defining a DOD ten point program to reduce attrition through the better use of incentives, improved training, and attention to the factors of family and employee support and major life events; (6) Development of a compensation model to determine the relative effectiveness of various compensation policies so that alternative policies for improving enlisted retention can be evaluated in order for the Services to meet career force objectives and reduce their demand for non-prior service accessions; (7) Development of a methodology to objectively measure the value that service personnel place on military benefits as opposed to their costs to DOD. Current plans include incorporating this method into future DOD-wide survey efforts with the results being used in future compensation policies and programs; (8) A DOD Stockage Policy Analysis resulting in specific recommendations for the much more effective use of the \$4.7B investment in safety levels and non-demand based stockage within DOD; (9) An analysis of economic retention/disposal policies for wholesale secondary items in the DOD showing that, in general, inventory "cost to hold" is very low in relation to "cost to repro cure", indicating that once we have an item in the inventory, we should exhaust all its potential before initiating disposal actions; (10) A multi-phased task focusing on the issue of reliability and maintainability (R&M) characteristics and associated maintenance factors over the system's life cycle. Extremely valuable results are being used for projecting logistics and support planning factors of weapon system R&M as the system moves through the DSARC process; (11) A series of analyses of civilian personnel policy issues resulting in valid, detailed and reliable information for policy planning and development, firm data for use in presenting DOD programs to Congress, and program development work upon which to base decisions and programs for the DOD Senior Executive Service; (12) A series of recommendations now being implemented relative to paysetting alternatives for blue-collar wage board reform. We estimate annual savings of \$500M by 1985 as a result.

2. FY 1982 Program: The FY 1982 program represents a priority based selection of the presently identified external research and study requirements for MRA&L. Work will be continued from promising FY 1981 efforts and initiated in the following areas: (1) Efforts to develop, analyze, and evaluate mobilization exercises, and manpower requirement determination improvement analyses (example: evaluation of major mobilization exercises such as Exercise PROUD SPIRIT, DOD/Selective Service System exercises, mobilization issues affecting US readiness to reinforce NATO); (2) Efforts to analyze the military compensation system (examples: military pay and retirement reform studies, evaluation of compensation policy under the AVF, analytical and technical support to the 5th Quadrennial Review of Military Compensation); (3) Efforts to improve DOD total force modeling and management (examples: active and reserve force modeling, analysis and implementation of the Defense Office Management Control System, DOD wartime civilian manpower requirements); (4) Efforts to quantify the influence of personnel policy and factors on military productivity, attrition and retention (examples: attrition information for the Reserve Components, prediction of military job performance, attrition reduction in the selected reserves, enlisted and officer attrition analyses, and analysis of the impact of personnel policies on job performance); (5) Efforts to increase total force supply (example: analysis of variable entrance standards for military service and alternative sources of manpower supply); (6) Efforts to improve civilian personnel management programs, policies and procedures; (7) Efforts to reduce and project logistics and manpower support costs of new weapon system (examples: development of policy guidelines supplemented by examples of analytical techniques for use in assessing alternative maintenance and support concepts in the DSARC review process, evaluation of commercial practices to reduce the acquisition cycle and improve R&M).

3. FY 1983 Program: The research and studies planned for FY 1983 are again concerned with the central issues of determination and evaluation of manpower requirements (military, civilian, and contract), total force analysis and planning, manpower modeling, military and civilian compensation analysis, improved personnel training, career development and retention, mobilization planning, development and testing and improved logistics support concepts. Proposed research projects also address Congressionally identified problems such as readiness levels, requirements determination, analysis of the recruiting market available to support the All Volunteer Force in the out years, and a series of long-range personnel policy issues and improved logistics support to new and fielded weapons systems. The FY 1983 research studies are deemed especially important in controlling manpower requirements and support costs.

4. FY 1984 Planned Program: The FY 1984 program will be a continuation of the FY 1983 program.

DEPARTMENT OF DEFENSE - MILITARY
SUPPORT TO SECRETARY OF DEFENSE ACTIVITIES AND ORGANIZATION OF THE JOINT CHIEFS OF STAFF
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
FY1983 Budget
Special Analysis Consultants, Studies and Analyses, and Management Support Contracts
(Dollars in Thousands)

Appropriation: RDT&E, Defense Agencies

	<u>FY1981</u>	<u>FY1982</u>	<u>FY1983</u>
A. <u>Experts and Consultants</u>	-	-	-
1. Personnel Appointments			
a. Experts			
b. Consultants			
(1) Federal Advisory Committee Members			
(2) All Other Appointed Consultants			
2. Contract Consultants			
B. <u>Studies and Analyses</u>	21,293	20,900	31,800
1. Consulting Services	-	-	-
2. Other	-	-	-
C. <u>Professional, Management and Services by Contract</u>	-	-	-
1. Program Management Support			
a. Consulting Services			
b. Other			
2. Policy Review and Development			
a. Consulting Services			
b. Other			

	<u>FY1981</u>	<u>FY1982</u>	<u>FY1983</u>
3. Specification Development			
a. Consulting Services			
b. Other			
4. System Engineering			
a. Consulting Services			
b. Other			
5. Technology Sharing/Utilization			
a. Consulting Services			
b. Other			
6. Logistic Support Services			
a. Consulting Services			
b. Other			
7. Technical Data Collection			
a. Consulting Services			
b. Other			
8. Other Professional, Management and Services by Contract			
a. Consulting Services			
b. Other			
D. <u>Contract Engineering & Technical Services</u>	-	-	-
TOTAL	<u>21,293</u>	<u>20,900</u>	<u>31,800</u>

	<u>FY1981</u>	<u>FY1982</u>	<u>FY1983</u>
E. <u>Summary</u>			
1. Personal Services	-	-	-
2. Contract Consulting Services	21,293	20,900	31,800
3. Other Contract Services	-	-	-
TOTAL	21,293	20,900	31,800

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Research, Development, Test, and Evaluation, Defense Agencies

USHS

08 FEB 82

Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est
Program by activities:							
Direct:							
	1. Technology base	1,400	1,650	1,800	1,296	1,698	1,741
	Reimbursable program	932	1,500	1,500	1,352	1,500	1,500
10.0001	Total	2,332	3,150	3,300	2,648	3,198	3,241
Financing:							
	Offsetting collections from:						
11.0001	Federal funds	-932	-1,500	-1,500	-837	-1,500	-1,500
	Unobligated balance available, start of year:						
21.4001	For completion of prior year budget plans				-648	-205	-157
21.4002	Reprogramming from or to prior year budget plan	-32					
24.4001	Unobligated balance available, end of year				205	157	216
25.0001	Unobligated balance lapsing	32			32		
40.0001	Budget authority (appropriation)	1,400	1,650	1,800	1,400	1,650	1,800

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Research, Development, Test, and Evaluation, Defense Agencies

USUHS

08 FEB 82

Object Classification (in thousands of dollars)

Identification code	97-0400-0-1-051	1981 actual	1982 est.	1983 est.
Direct obligations:				
Personnel compensation:				
111.301	Other than full-time permanent		36	54
112.101	Civilian personnel		3	5
123.201	Communications, utilities and other rent	2		
Other services:				
125.004	Other	17	24	37
126.001	Supplies and materials	622	756	893
131.001	Equipment	655	879	752
199.001	Total direct obligations	1,296	1,698	1,741
Reimbursable obligations:				
Personnel compensation:				
211.101	Full-time permanent	325		
211.301	Other than full-time permanent	34	498	576
211.901	Total personnel compensation	359	498	576
212.101	Civilian personnel	33	42	49
221.001	Travel and transportation of persons	17	20	22
223.201	Communications, utilities and other rent	2		
Other services:				
225.004	Other	56	60	65
226.001	Supplies and materials	366	526	570
231.001	Equipment	512	346	208
241.001	Grants, subsidies, and contributions	7	8	10
299.001	Total reimbursable obligations	1,352	1,500	1,500
999.901	Total obligations	2,648	3,198	3,241

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES

RDT&E DEFENSE AGENCIES

PERSONNEL SUMMARY

	<u>FY 1981 ACTUAL</u>	<u>FY 1982 ESTIMATE</u>	<u>FY 1983 ESTIMATE</u>
TOTAL NUMBER OF PERMANENT POSITIONS	24	53	53
TOTAL COMPENSABLE WORK YEARS	21	30	35
FULL-TIME EQUIVALENT OF OTHER POSITIONS	(-0-)	(-0-)	(-0-)
FULL-TIME EQUIVALENT OF OVERTIME AND HOLIDAY LEAVE	(-0-)	(-0-)	(-0-)
AVERAGE ES SALARY	-0-	-0-	-0-
AVERAGE GS GRADE	6.71	6.71	6.71
AVERAGE GS SALARY	\$15,333	\$16,118	\$16,150
AVERAGE SALARY, POSITIONS ESTABLISHED BY SECRETARY OF DEFENSE (PUBLIC LAW-426)	\$19,444	\$20,000	\$20,467
AVERAGE SALARY OF UNGRADED POSITIONS	-0-	-0-	-0-

SUMMARY BY BUDGET ACTIVITY
UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
(\$ IN THOUSANDS)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
1. Technology Base	1,400	1,650	1,800	1,824
2. Advanced technology development				
3. Strategic programs				
4. Tactical programs				
5. Communications and electronics				
6. Defense-wide mission and support				
TOTAL RDT&E - DIRECT	1,400	1,650	1,800	1,824
Reimbursements	1,352	1,500	1,500	1,500
TOTAL PROGRAM	\$2,752	\$3,150	\$3,300	\$3,324

SUMMARY BY PROGRAM CATEGORY
UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
(\$ In Thousands)

	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>
6.1 Research	1,400	1,650	1,800	1,824
6.2 Exploratory Development				
6.3 Advanced Development				
6.4 Engineering Development				
6.5 Management and Support				
Total Research and Development (Program 6)	1,400	1,650	1,800	1,824
Total Operational Systems Program	-	-	-	-
Total RDT&E - Direct	1,400	1,650	1,800	1,824
Reimbursements	1,352	1,500	1,500	1,500
TOTAL PROGRAM	\$2,752	\$3,150	\$3,300	3,324

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Research, Development, Test, and Evaluation, Defense Agencies

USUHS

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Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.

Program by activities:							
Direct:							
	1. Technology base				101		
	Reimbursable program				420		
10.0001	Total				521		

Financing:							
Offsetting collections from:							
11.0001	Adjustment to prior year federal fund order				95		
	Unobligated balance available, start of year:						
21.4001	For completion of prior year budget plans				-648		
21.4002	Reprogramming from or to prior year budget plan	-32					
25.0001	Unobligated balance lapsing	32			32		

40.0001	Budget authority (appropriation)						

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
1. Technology base		1,400			1,195	205	
Reimbursable program		932			932		
10.0001	Total	2,332			2,127	205	
Financing:							
Offsetting collections from:							
11.0001	Federal funds	-932			-932		
21.4001	Unobligated balance available, start of year					-205	
24.4001	Unobligated balance available, end of year				205		
40.0001	Budget authority (appropriation)	1,400			1,400		

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Research, Development, Test, and Evaluation, Defense Agencies

USUHS

08 FEB 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	1. Technology base		1,650			1,493	157
	Reimbursable program		1,500			1,500	
10.0001	Total		3,150			2,993	157
Financing:							
Offsetting collections from:							
11.0001	Federal funds		-1,500			-1,500	
21.4001	Unobligated balance available, start of year						-157
24.4001	Unobligated balance available, end of year					157	
40.0001	Budget authority (appropriation)		1,650			1,650	

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
	1. Technology base			1,800			1,584
	Reimbursable program			1,500			1,500
10.0001	Total			3,300			3,084
Financing:							
Offsetting collections from:							
11.0001	Federal funds			-1,500			-1,500
24.4001	Unobligated balance available, end of year						216
40.0001	Budget authority (appropriation)			1,800			1,800

PERFORMER DISTRIBUTION
UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
RESEARCH, DEVELOPMENT, TEST AND EVALUATION
(\$ IN THOUSANDS)

	Total Obligational Authority			
	1981	1982	1983	1984
1. For operation of installations of the reporting DoD Component <u>Government operated</u>	\$1,400	\$1,650	\$1,800	\$1,824
2. For operation of installations of the reporting DoD Component <u>Contractor operate</u>				
3. For contracts directly in support of work actually performed at installations of the reporting DoD Component.....				
4. For work assigned to other Department of Defense activities.....				
5. For work assigned to activities of other Government agencies.....				
6. For work performed by industrial contractors ("profit" organizations)				
7. For work performed by educational institutions.....				
a. <u>Designated Fed. Contract Res. Centers</u>				
b. <u>Other Institutions</u>				
8. Total RDT&E appropriation.....	\$1,400	\$1,650	\$1,800	\$1,824

INSTALLATION ANALYSIS - IN-HOUSE
UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
RESEARCH, DEVELOPMENT, TEST AND EVALUATION

TOA (\$ IN THOUSANDS)										PERSONNEL (Man-Years)							
										Civil Service				Contractor		Mil.	Pers.
										Paid		Paid		Paid		Paid	
										From	Parent	From	Parent	From	Parent	from	from
										Dept.	Other	Dept.	Other	Dept.	Other	Work	Other
Installation & Location	FY	Mgt. Etc.	Other Parent Dept.	Other DoD	All Other Funds	1/ Subtotal	Mil. RDT&E	Per. Other	Total	RDT&E	RDT&E	RDT&E	RDT&E	RDT&E	RDT&E	Work	Other
Uniformed Services University of the Health Sciences, Bethesda, Md.	81	\$1,400	-0-	-0-	-0-	\$1,400	-0-	-0-	\$1,400	-0-	-0-	28	-0-	-0-	-0-	-0-	-0-
	82	\$1,650	-0-	-0-	-0-	\$1,650	-0-	-0-	\$1,650	5	-0-	56	-0-	-0-	-0-	-0-	-0-
	83	\$1,800	-0-	-0-	-0-	\$1,800	-0-	-0-	\$1,800	5	-0-	56	-0-	-0-	-0-	-0-	-0-
	84	\$1,824	-0-	-0-	-0-	\$1,824	-0-	-0-	\$1,824	5	-0-	56	-0-	-0-	-0-	-0-	-0-

1/ Excludes Military Personnel and Military Construction

FY 1983 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101W
DoD Mission Area: #510 Defense Research

Title: In-House Laboratory Independent Research
Budget Activity: Technology Base

A. RESOURCES: (PROJECT LISTING): (\$ in thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Actual</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>FY 1984 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	TOTAL FOR PROGRAM ELEMENT	\$1,400	\$1,650	\$1,800	\$1,824	Continuing Programs	Continuing Programs

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

The research program is designed to answer basic medical questions of importance to the mission of the Department of Defense. This program currently includes research in the areas of: Combat Casualty Care, Systems Biotechnology, Infectious Diseases, and Ionizing Radiation Bioeffects.

C. BASIS FOR FY 1983 RDT&E REQUEST:

The USUHS Research Program, being an integral part of the teaching mission of the USUHS, is a continuing program. The FY 1983 request will allow for the continuation of research that is currently ongoing. It will also provide for an expansion of those programs and the beginning of investigations into other fields of importance to the military mission.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

<u>RDT&E</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional to Completion</u>	<u>Estimated Cost</u>
Funds (current requirements)	1,400	1,650	1,800	Continuing	N/A
Funds (as shown in the FY 1982 submission)	1,400	1,650	1,750	Continuing	N/A

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E. OTHER APPROPRIATION FUNDS: N/A

F. DETAILED BACKGROUND AND DESCRIPTION:

The faculty of the Uniformed Services University of the Health Sciences conducts basic biomedical research in the health sciences. Faculty involved in the teaching programs must engage in research in their own areas of expertise to remain current with the advances in scientific knowledge. Students acquire a foundation for continuing self-education by observation of scientific methods and direct exposure to working professionals.

G. RELATED ACTIVITIES:

Some of this investigative effort is in collaboration with Walter Reed Army Medical Center; Walter Reed Army Institute of Research; National Naval Medical Center; the Naval Medical Research Institute; the Institute of Chemical Defense and the Chemical Systems Laboratory, Aberdeen Proving Ground, Maryland; the Armed Forces Radiobiology Research Institute; and the National Institutes of Health. However the bulk of the effort is specialty-oriented research conducted in the basic science laboratories of the University.

H. WORK PERFORMED BY:

All work performed in this Program Element is done in-house. Research activities are coordinated at DoD level in an attempt to avoid duplication of effort with other medical research programs within the Agency. Special efforts are made to coordinate with the appropriate service where lead agency status has been established in specific areas of medical research.

I. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1981 and Prior Accomplishments:

a. COMBAT CASUALTY CARE

Refinement of vein grafting techniques; evaluation of new approaches to treatment of ocular trauma; establishment of techniques which estimate alcohol and drug exposure by a non-invasive method; determination of anesthetic agent effects on catecholamine release; description of an airway resistance model and determination of factors which limit ventilatory performance; elucidation of role of vasoactive peptides in hemorrhagic and toxic shock; description of techniques using prosthetic arteries; and evaluation of factors which contribute to serious bacterial infections in wound patients due to predisposing factors such as devitalized tissue and foreign debris.

b. SYSTEMS BIOTECHNOLOGY

Characterization of action of metabolizing enzymes on toxic substances; description of effects of heavy metals and other toxic substances such as PCBs on liver, lung, and kidney function; characterization of cardiac performance under stressful conditions; description of hematologic and cardiovascular changes induced by exercise and physical conditioning; and description of blood flow regulation in muscle tissue.

c. INFECTIOUS DISEASES

Determination of role of modified human immunoglobulin in streptococcal immunity; characterization of acute and chronic upper respiratory infections caused by coronavirus; characterization of relationship between virulence and toxin production in cholera infections; description of improved method of immunization against cholera; evaluation of biochemical approaches to chemotherapy of African trypanosomiasis (sleeping sickness); characterization of virulence in typhoid infections; description of mechanisms of immunity in malaria; and characterization of antigenic and serologic relationships among strains of parasites causing leishmaniasis.

d. IONIZING RADIATION BIOEFFECTS

Description of cardiovascular malfunction due to exposure to radiation.

2. FY 1982 Program:

The FY 1982 program will continue funding productive research efforts currently underway and begin new studies of military relevance. New efforts will include studies to preserve heart function in irreversible shock; the role of endorphins in the regulation of cardiovascular function; the role of endorphins in reaction to stress, pain, and injury; determination and treatment of central respiratory effects induced by chemical agents; studies of skin components important in wound healing; effects of route of administration of morphine upon respiration; and characterization of immune responses to numerous infectious disease agents.

3. FY 1983 Planned Program:

Continuation in the areas of basic research outlined in the FY 1982 program is planned.

4. FY 1984 Planned Program:

Continuation in the areas of basic research outlined in the FY 1982 program is planned.

5. Program to Completion:

This is a continuing program.

Research, Development, Test, and Evaluation, Defense Agencies

DRSP

21 JAN 81

Program and Financing (in thousands of dollars)

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities.							
Direct:							
10.0001	Total						
Financing:							
21.4001	Unobligated balance available, start of year						
24.4001	Unobligated balance available, end of year						
40.0001	Budget authority (appropriation)						

Object Classification (in thousands of dollars)

Identification code		97-0400-0-1-051		
		thousands of dollars		
		1981 actual	1982 est.	1983 est.

Other services:				
125.003	Contracts			

999.901	Total obligations			

DEPARTMENT OF DEFENSE - MILITARY
 DEFENSE RECONNAISSANCE SUPPORT PROGRAM
 RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES

SUMMARY BY BUDGET ACTIVITY
 (\$ in Thousands)

	<u>FY 1981</u> <u>ESTIMATE</u>	<u>FY 1982</u> <u>ESTIMATE</u>	<u>FY 1983</u> <u>ESTIMATE</u>	<u>FY 1984</u> <u>ESTIMATE</u>
5.0 Intelligence and Communications	--			
Total Program	--			

SUMMARY BY PROGRAM CATEGORY

3.5 Operational Systems Development	--
Total Program	--

Research, Development, Test, and Evaluation, Defense Agencies

DRSP

21 JAN 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
10.0001	Total						
Financing:							
21.4001	Unobligated balance available, start of year						
24.4001	Unobligated balance available, end of year						
40.0001	Budget authority (appropriation)						

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0400-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
10.0001	Total						
Financing:							
24.4001	Unobligated balance available, end of year						
40.0001	Budget authority (appropriation)						

DEPARTMENT OF DEFENSE - MILITARY
DEFENSE RECONNAISSANCE SUPPORT PROGRAM
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES
PERFORMER DISTRIBUTION
(\$ in Thousands)

	<u>Total Obligational Authority</u>			
	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>FY 1984</u>
1. For operation of installation of the DRSP - <u>Government Operated</u>	--	--	--	--
2. For operation of installation of the DRSP - <u>Contractor Operated</u>	--	--	--	--
3. For contracts directly in support of work actually performed at installations of the DRSP	--	--	--	--
4. For work assigned to other DOD activities	--	--	--	--
5. For work assigned to activities of other government agencies	--	--	--	--
6. For work performed by industrial contractors	--	--	--	--
7. For work performed by educational institutions:				
a. Designated FCRC	--	--	--	--
b. Other Institutions	--	--	--	--
8. For work performed by other "non-profit" organizations:				
a. Designated FCRC	--	--	--	--
b. Other Institutions	--	--	--	--
640. Total R&D Appropriation	--	--	--	--

DESCRIPTIVE SUMMARIES AND OTHER DETAILS ON DEFENSE RECONNAISSANCE SUPPORT
PROGRAMS ARE NOT INCLUDED AS THEY REQUIRE SPECIAL ACCESS.

APPROPRIATION LANGUAGE
DIRECTOR FOR TEST AND EVALUATION, DEFENSE

For expenses, not otherwise provided for, of independent activities of the Director of Defense Test and Evaluation in the direction and supervision of test and evaluation, including initial operational testing and evaluation; and performance of joint testing and evaluation; and administrative expenses in connection therewith; [\$53,000,000] \$60,000,000, to remain available for obligation until September 30, [1983] 1984. (Department of Defense Appropriation Act, 1982; additional authorizing legislation to be proposed.)

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Director of Test and Evaluation, Defense

08 FEB 82

Program and Financing (in thousands of dollars)

Identification code	97-0450-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est.	1983 est.	1981 actual	1982 est.	1983 est.
Program by activities:							
Direct:							
10 0001	Defensewide mission support (object class 25.0)	42,100	53,000	60,000	41,051	50,900	58,400
Financing:							
	Unobligated balance available, start of year:						
21 4001	For completion of prior year budget plans				-9,598	-10,642	-12,742
21 4002	Reprogramming from or to prior year budget plan	-5					
24 4001	Unobligated balance available, end of year				10,642	12,742	14,342
25 0001	Unobligated balance lapsing	5			5		
40 0001	Budget authority (appropriation)	42,100	53,000	60,000	42,100	53,000	60,000
Relation of obligations to outlays:							
71 0001	Obligations incurred, net				41,051	50,900	58,400
72 4001	Obligated balance, start of year				27,236	32,556	40,056
74 4001	Obligated balance, end of year				-32,556	-40,056	-46,256
77 0001	Adjustments in expired accounts				12		
90 0001	Outlays, excluding pay raise supplemental				35,743	43,400	52,200
121 001	Travel and transportation of persons					50	60
Other services:							
125 003	Contracts				41,051	50,850	58,340
999 901	Total obligations				41,051	50,900	58,400

Director of Test and Evaluation, Defense

08 FEB 82

Program and Financing (in thousands of dollars)

1982 Fiscal year program

Identification code	97-0450-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est
Program by activities:							
Direct:							
10.0001	Defensewide mission support (object class 25.0)		53,000			40,258	12,742
Financing:							
21.4001	Unobligated balance available, start of year						-12,742
24.4001	Unobligated balance available, end of year					12,742	
40.0001	Budget authority (appropriation)		53,000			53,000	

Program and Financing (in thousands of dollars)

1983 Fiscal year program

Identification code	97-0450-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est
Program by activities:							
Direct:							
10.0001	Defensewide mission support (object class 25.0)			60,000			45,658
Financing:							
24.4001	Unobligated balance available, end of year						14,342
40.0001	Budget authority (appropriation)			60,000			60,000

Director of Test and Evaluation, Defense

08 FEB 82

Program and Financing (in thousands of dollars)

1980 Fiscal year program

Identification code	97-0450-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est

Program by activities:

Direct:

10.0001 Defensewide mission support
(object class 25.0)

9,593

Financing:

21.4001 Unobligated balance available, start of year

-9,598

21.4002 For completion of prior year budget plans

-5

25.0001 Reprogramming from or to prior year budget plan

5

25.0001 Unobligated balance lapsing

40.0001 Budget authority (appropriation)

Program and Financing (in thousands of dollars)

1981 Fiscal year program

Identification code	97-0450-0-1-051	Budget plan (amounts for RDT&E actions programmed)			Obligations		
		1981 actual	1982 est	1983 est	1981 actual	1982 est	1983 est

Program by activities:

Direct:

10.0001 Defensewide mission support
(object class 25.0)

42,100

31,456

10,642

Financing:

21.4001 Unobligated balance available, start of year

-10,642

24.4001 Unobligated balance available, end of year

10,642

40.0001 Budget authority (appropriation)

42,100

42,100

RESEARCH, DEVELOPMENT, TEST AND EVALUATION
DIRECTOR OF TEST AND EVALUATION, DEFENSE APPROPRIATION

PERFORMER DISTRIBUTION
(Thousands of Dollars)

	Total Obligational Authority			
	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	FY 1984 Estimate
1. For operation of installations of the reporting DoD component - Government operated				
2. For operation of installations of the reporting DoD component - Contractor operated				
3. For contracts <u>directly in support</u> of work actually performed at installations of the reporting DoD component.				
4. For work assigned to other Department of Defense activities.	38,948	47,007	53,892	56,830
5. For work assigned to activities of other Government agencies.				
6. For work performed by industrial contractors ("profit" organizations). . .	0	1,500	1,700	2,000
7. For work performed by educational institutions				
a. <u>Designated Federal Contract Research Centers</u>				
b. <u>Other institutions</u>				
8. For work performed by other "nonprofit" organizations				
a. <u>Designated Federal Contract Research Center</u>	3,152	4,443	4,408	4,872
b. <u>Other institutions</u>				
9. Total RDT&E Appropriation	42,100	53,000	60,000	63,702

RESEARCH, DEVELOPMENT, TEST AND EVALUATION
 DIRECTOR OF TEST AND EVALUATION, DEFENSE APPROPRIATION
 FEDERAL CONTRACT RESEARCH CENTERS SUMMARY
 (Thousands of Dollars)

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
<u>Systems Integration/Technical Direction FCRC's:</u>				
1. MITRE Corporation	877	993	1,108	1,222
<u>Operational Research/System Analysis FCRC's:</u>				
1. Institute for Defense Analyses	<u>2,275</u>	<u>3,500</u>	<u>3,300</u>	<u>3,600</u>
TOTAL	3,152	4,493	4,408	4,822

RESEARCH, DEVELOPMENT, TEST AND EVALUATION
DIRECTOR OF TEST AND EVALUATION, DEFENSE APPROPRIATION

INSTALLATION ANALYSIS - FCRC's
(Thousands of Dollars)

R D T & E F U N D S				P E R S O N N E L		
FCRC & Location	Fiscal Year	From Parent Dept	Total	Professionals Paid From	Support Personnel Paid From	Total
				Parent Department RDT&E	Parent Department RDT&E	
Institute for Defense Analyses Arlington, VA	1981	2,275	2,275	22	28	50
	1982	3,500	3,500	29	36	65
	1983	3,300	3,300	25	31	56
	1984	3,650	3,650	25	31	56
MITRE Corp. McLean, VA and Bedford, MA	1981	877	877	10	2	12
	1982	993	993	10	2	12
	1983	1,108	1,108	10	2	12
	1984	1,222	1,222	10	2	12

RESEARCH, DEVELOPMENT, TEST AND EVALUATION
DIRECTOR OF TEST AND EVALUATION, DEFENSE APPROPRIATION

PROJECT LISTING
(Thousands of Dollars)

Budget Activity 6 - Defensewide and Mission Support
Program Category 6.5 - Management and Support

	<u>FY 1981</u> <u>Actual</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>FY 1984</u> <u>Estimate</u>
PE 65804D	32,950	42,100	48,400	50,556
PE 65111D	<u>9,150</u>	<u>10,900</u>	<u>11,600</u>	<u>13,146</u>
Total Program	42,100	53,000	60,000	63,702

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DESCRIPTIVE SUMMARIES FOR
THE DIRECTOR OF TEST AND EVALUATION, DEFENSE APPROPRIATION

FY 1983 BUDGET REQUEST

FY 1984 AUTHORIZATION REQUEST

*** JANUARY 1982 ***

NARRATIVE DESCRIPTION

The Descriptive Summaries for Program Elements 65804D and 65111D support the responsibilities of the Director Defense Test and Evaluation, Office of the Under Secretary of Defense for Research and Engineering, for independent activities in the direction and supervision of test and evaluation, for joint testing, for study efforts to improve the effectiveness and efficiency of the 19 DoD Major Ranges and Test Facilities, and for a continuing program for technical and/or operational evaluation of foreign nations' weapon systems, equipment, and technologies.

DIRECTOR OF TEST AND EVALUATION, DEFENSE APPROPRIATION
FY 1983 RDT&E Descriptive Summary

Program Element: #65804D
 DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
 Budget Activity: 6 - Defensewide Mission Support

A. <u>RESOURCES:</u> (\$ in Thousands)	FY 1981	FY 1982	FY 1983	FY 1984	Additional	Total
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated costs</u>
Total for Program Element	32,950	42,100	48,400	50,556	Continuing	N A

B. BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports responsibilities of the Director Defense Test and Evaluation (DDTE), Office of the Under Secretary of Defense for Research and Engineering, for independent activities in the direction and supervision of test and evaluation, for joint testing, and for study efforts to improve the effectiveness and efficiency of the 19 DoD Major Ranges and Test Facilities. These responsibilities evolved from the Blue Ribbon Defense Panel Report of 1970 which made several recommendations concerning test and evaluation and specifically commented on the requirement for conducting much-needed, productive joint operational tests and evaluations. Major effort is devoted to reimbursing the Services for unique costs incurred in conducting joint tests, those selected by the DDTE in coordination with OSD elements, the JCS, and the Services, and those directed by the Secretary of Defense or the Congress.

C. BASIS FOR FY 1983 REQUEST: Continue six (6) joint tests initiated in prior years (Command, Control, and Communications Countermeasures; Data Link Vulnerability; Electro-Optical Guided Weapons Countermeasures/Counter-Countermeasures; Forward Area Air Defense; Identification of Friend, Foe, or Neutral; and Joint Logistics Over-The-Shore II). Since no joint tests will be initiated in FY 1983, a total of six will be funded. Conduct feasibility determinations on joint tests proposed by the Services, the Joint Chiefs of Staff, the Unified/Specified Commanders, and OSD elements for initiation in FY 1984.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The increase in the FY 1983 request as compared to the FY 1983 estimate made a year ago (\$48,400 thousand vs \$40,700 thousand) is due primarily to a refinement of the scope and objectives of the Forward Area Air Defense Joint Test and a more intensive, compressed schedule for the Identification Friend, Foe, or Neutral (IFFN) Joint Test. Further, the main effort of the Command, Control, and Communications Countermeasures (C3CM) Joint Test has been delayed, requiring additional FY 1983 funds. FY 1982 funds intended for C3CM were reprogrammed to meet previously unfunded requirements of IFFN and the Electronic Warfare During Close Air Support tests.

E. OTHER APPROPRIATION FUNDS: The Services participating in these joint tests provide, without reimbursement, equipment and weapon systems for tests as well as operational military forces which are required. The Services are reimbursed for unique costs incurred as a result of a directed test but not for normal operation and maintenance costs incurred in support of joint tests.

Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

F. DETAILED BACKGROUND AND DESCRIPTION: The Director of Test and Evaluation, Defense Appropriation provides for independent activities in the direction and supervision of test and evaluation, joint testing, study efforts to improve the effectiveness and efficiency of the 19 DoD Major Ranges and Test Facilities, and technical and/or operational evaluation of foreign nations' weapons and technologies. Responsibility for this appropriation, assigned to the Director Defense Test and Evaluation (DDTE) includes (1) initiation and accomplishment of such joint tests as are necessary, (2) overseeing for OSD its major ranges and test facilities, and (3) administration of the DoD Foreign Weapons Evaluation program.

This program element supports the responsibilities of the DDTE for other than Foreign Weapons Evaluation. In carrying out these responsibilities, the DDTE identifies candidate projects for joint tests in coordination with OSD elements, the JCS, and the Services. These joint tests are structured to evaluate system performance under realistic operational conditions with two or more Services participating on interrelated/interacting weapons systems as well as to resolve technical development problems. The data from these tests are used for evaluating system suitability for the intended mission; for force structure planning; for definition of requirements; for weapons improvements; and for assistance in making decisions in the acquisition process. The costs incurred under this program element are those which are unique to the needs of a joint test, such as: a determination of whether a proposed test is feasible; the provision for test design and planning support for joint tests selected; the development, procurement, installation, and operation of special instrumentation; transportation, travel, and per diem costs for the Test Director's staff; the modification of test articles to be suitable as surrogates and to permit obtaining test data; transportation of equipment from permanent bases to the test site and return; and the provision of data collectors and services for data collection, data reduction, analysis, and test reporting. The Services provide available equipment and weapon systems for the tests without reimbursement.

G. RELATED ACTIVITIES: The Services conducting or assisting in joint tests provide for the expenses of operational military forces which are assigned to participate in the joint tests and evaluations.

H. WORK PERFORMED BY: Feasibility determination for joint tests and evaluations will be performed either by qualified Government Research Centers or by qualified contractor personnel under the guidance of OSD test and evaluation personnel. Joint test designs will be accomplished by the Institute for Defense Analyses (IDA), Science Applications, Inc. (SAI), Technology Service Corporation (TSC) and other contractors. Each joint test will be conducted by a designated Military Department assisted by other appropriate Military Departments. The test data will be evaluated and reported upon separately by the Test Director and by IDA or other responsible contractors directly to the OSD elements. The study efforts for improving the major ranges and test facilities will be accomplished primarily by the MITRE Corporation.

Program Element: #658040
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

1. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1982 and Prior Accomplishments and FY 1983 Planned Program: Since the initiation of the E-O MAVERICK joint test in 1972, twenty-seven (27) additional joint tests have been started. Of these, four (4) have been terminated and sixteen (16) have been completed. Two (2) new joint tests (Joint Logistics Over-The-Shore II and Joint Direction Finding) were planned for FY 1982, making a total of ten (10) tests underway in FY 1982. Two (2) joint tests (Central Region Airspace Control Plan and Electronic Warfare During Close Air Support) are to be completed in FY 1982 and two (2) joint tests are being terminated (Joint Direction Finding and Theater Air Defense). No new joint tests are to be started in FY 1983. Thus, in FY 1983 there will be six (6) joint tests underway.

Advanced Anti-Armor Combat Vehicle Joint Test: The objective of this joint test was to provide data for evaluation of performance parameters of conceptual lightweight, anti-armor combat vehicles, and their associated weapons systems for determination of critical characteristics for development/refinement of appropriate requirements documents. Existing test bed vehicles were modified to provide suitable surrogates for operational concept testing in a combined arms scenario. Test feasibility evaluations to scope the program and a test design were completed during FY 1979. The main force-on-force tests involving surrogate vehicles and various fire control and weapon systems were conducted in September - December 1980. Analysis and reporting of results were completed during FY 1981. The Advanced Anti-Armor Combat Vehicle Joint Test is commonly referred to as ARMVAL.

Tactical Aircraft Effectiveness and Survivability in Anti-Armor Operations Joint Test: The objective of this joint test was to evaluate the survivability and effectiveness of various tactical aircraft in close air support anti-armor operations. A number of aviation systems and subsystems have been procured or developed in recent years (e.g., AH-1S, A-10, AV-8, etc.), each with an anti-armor capability. During the same time period, estimates of enemy air defense capability were significantly upgraded. This joint test took a fresh look at the effectiveness and survivability of various aircraft/weapon systems in a realistic combat situation. The test design was completed in November 1977 and the test force was established in late FY 1977. A detailed test plan was completed in May 1979. Test instrumentation was in place by March 1979 with actual testing beginning in July 1979. A preliminary report was published in July 1980. The final analysis and report were completed in FY 1981. The Tactical Effectiveness and Aircraft Survivability in Anti-Armor Operations Joint Test is commonly referred to as TASVAL.

Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

Central Region Airspace Control Plan (CRACP) Evaluation: The objective of this joint test is to evaluate the effectiveness of existing and proposed central region airspace control procedures/systems which are designed to resolve conflicts among friendly forces employing common airspace in the forward combat zone. Particular emphasis will be placed on evaluating existing and proposed techniques for controlling offensive air support aircraft and friendly short range air defense (SHORAD) units. A feasibility study to provide preliminary program definition has been completed. That study identifies major airspace control issues (e.g., effective control of SHORADS, ability of aircraft to adhere to proposed airspace control procedures) and proposes a sequence of test vehicles to assess these issues. These test vehicles include: analyses/fast time simulations; manned simulators (i.e., the test bed being assembled for the Identification of Friend, Foe, or Neutral (IFFN) joint test); piggybacking on field test exercises; and a dedicated field test. The dedicated field test phase will focus upon the airspace control problems posed by SHORADS (i.e., it will establish a baseline of performance and evaluate the utility of additional information to these weapon system operations). The FY 1980 program included funds to begin analyses/fast time simulations to assess the ability of: (1) aircraft to adhere to airspace control procedures, and (2) air defense units with a beyond visual range capability to recognize adherence. The analyses continued during FY 1981. In FY 82 the evaluation will be completed.

Electronic Warfare During Close Air Support (EW/CAS) Joint Test: The EW/CAS program was conducted in two phases. Phase I, the Tactical Communications Jamming Phase, completed in March 1980, was devoted to investigating the effectiveness of Soviet jamming of U.S. tactical communications associated with conducting air support operations (with both fixed-wing aircraft and attack helicopters). Phase II, designated as the Air Support Operations Phase, was completed at Nellis Air Force Base, Nevada in November 1981. The general objective of Phase II was to assess the relative effectiveness or contribution of electronic countermeasures, defense suppression, and tactics on close air support and attack helicopter operations. Data reduction, evaluation, and analysis of Phase II is currently scheduled to be completed in November 1982.

Joint Direction Finding (JDF). Joint direction finding support to tactical operations was proposed by CINCPAC as a FY 1982 joint operational test to determine if DF assets not presently netted together, or those functioning independently, can be joined in a manner that will support the combat information needs of the tactical commander. Under the test concept, a DF net control would assume management of other Services' assets to maximize theater capability. A feasibility study was conducted by the Navy to determine if the test could be conducted in conjunction with exercise Kernal Usher during late 1982 or early 1983. It has been determined that desired results can be obtained by using existing assets and command structure without a requirement for establishing a joint test and using PE 65804D funds. Therefore, JDF has been terminated.

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Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

Theater Air Defense (TAD) Evaluation: An operational test and evaluation of joint command and control of airspace during defensive battle operations was proposed by the JCS and USAF. The concept was that the primary objectives of this evaluation be satisfied by augmenting the evolving Identification of Friend, Foe, or Neutral (IFFN) Test Bed. Because of the interrelationships between TAD and IFFN, and the acceleration of the IFFN schedule, it was determined that TAD should be deferred until a later date, depending on progress and early results of IFFN.

Command, Control, and Communications Countermeasures (C3CM) Joint Test: The objective of this joint operational test program is to assess the effectiveness of current and planned US forces in countering Soviet Command, Control, and Communications. The test program will support the development of tactics and assist hardware developers to identify system requirements or improvements that would enhance US C3CM capabilities. Test concept definitions were undertaken in 1978 by four selected contractors. The FY 1979 program included funding for a single unified test concept based on the four contractor studies. The FY 1980 program funded analyses of Soviet equipment and tactics, US C3CM capabilities, and development of C3CM scenarios for testing. Based upon the results of these studies, detailed planning is proceeding on field tests and on development and procurement of simulation equipment. In FY 1981, five preliminary tasks were assigned to the Joint Electronic Warfare Center, addressing scenario validation, the role of computer modeling and simulation, Blue C3CM material systems and current Service C3CM concepts and activities. FY 1982 funding supports the establishment and operation of the Joint Test Directorate, procurement of instrumentation and threat simulation hardware, and conduct of the initial test planning. Results of simulations and field tests will be combined to develop an analytical base for use in training and in development of tactics and equipment.

FY 1983 Planned Program: Efforts will continue on test planning, simulation and analysis, wargaming studies, hardware procurement, and site preparation.

Data Link Vulnerability Joint Test: The objective of this joint test is to develop and validate a methodology to assess the performance of data links when employed in a hostile electronic environment. This methodology will be designed to evaluate the anti-jam characteristics of the data links against known and predicted levels of jamming to include the effects of alternative tactics, multiple jammer scenarios and techniques, atmospheric propagation effects, non-intentional jamming, and man-machine interfaces. Tests to validate the methodology are being accomplished in as realistic a threat electronic countermeasures (ECM) environment as feasible. This program, originally restricted to tactical data links, was expanded in 1979 to include typical digital weapon control; command, control, and communications (C); and reconnaissance (I) data links. A field test of the WALLEYE glide bomb was conducted in FY 1979 to evaluate selected measures of effectiveness. The results showed that additional studies to define improved measures of effectiveness were needed. These additional studies are continuing into FY 1982. Simulations have been designed to evaluate data link hardware performance against the previously defined variables. Field tests are being designed and conducted to validate simulation results, update the test methodology, and provide the basis of documentation.

656 FY 1983 Planned Program: FY 1982 activities will be continued.

Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

Electro-Optical Guided Weapons Countermeasures Joint Test: The objectives of this joint test are to determine the operational effectiveness of our electro-optical (E-O) guided weapons (Ultra-Violet (UV), Infrared (IR), TV, and LASER) in a countermeasures (CM) environment, to provide information to developers for effective counter-countermeasures (CCM) actions, and to evaluate the effectiveness of countermeasures techniques and devices against selected electro-optical guided weapon systems. This program was initiated in FY 1976 by using the existing Joint Test Force personnel, Mobile Instrumentation Facility (MIF), other instrumentation devices, and data base assembled during the earlier OSD-sponsored LASER Guided Weapons Countermeasures Joint Test program. Emphasis continues on static, captive-flight, and dynamic field testing of E-O weapon systems, development of CM techniques and devices, and susceptibility/vulnerability analyses of E-O guided weapons in realistic environments.

FY 1983 Planned Program: This effort is sponsored by the Director Defense Test and Evaluation to insure the continued effectiveness of current and developmental E-O guided weapons in an increasingly sophisticated countermeasures environment.

Forward Area Air Defense Evaluation: The objective of this joint test program is to evaluate existing and proposed techniques for controlling offensive air support aircraft and friendly short range air defense (SHORADS) units. To accomplish this objective, a dedicated field test will be conducted in which the performance of SHORADS operators will be assessed as a function of the degree and quality of external information which is available from the C² system. The SHORADS operators will be characterized by their effectiveness in engaging hostile aircraft while allowing friendly aircraft to pass unengaged. As supporting effort, field test exercises and fast time simulation evaluations will be conducted to evaluate the ability of aircraft to adhere to existing and proposed airspace control procedures.

The FY 1979 JT&E program included funding for a joint battlefield airspace control (JBAC) feasibility study in which a strawman FAAD test design was performed and preliminary estimates were made of required resources and funding. The FY 1980 program included funds to begin the long-lead-time planning for the dedicated field test. During FY 1982 the concept definition study was initiated. In FY 1982 funding includes completion of concept study, formulation of a Joint Test Force, and initiation of test design and planning.

FY 1983 Planned Program: Completion of test plan and conduct of initial test trials.

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Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

Identification Friend, Foe, or Neutral (IFFN) Joint Test. This program has two fundamental objectives. First, to establish baseline IFFN performance under varying conditions. Second, to develop and demonstrate improved IFFN techniques which will enhance the ability of Air Defense System Controller to accurately and swiftly identify, and to respond appropriately to observed potential targets. Specifically, the test is to: evaluate our capability to perform the IFFN function within the command and control system; to determine weak nodes; and to test near-term procedural and equipment improvements. The test is oriented to the NATO Central European area. A Joint Test Force (JTF) has been formed and will accomplish the test employing a geographically distributed test bed of actual manned weapon and command and control system nodes. The test bed will be controlled by a Central Simulation Facility (CSF) and is to incorporate all identification information sources used in combat. The test bed will be built in stages beginning with Army HIMADS and air defense C² modes. Subsequent stages will integrate Air Force systems into the test bed. Test bed design definition and source selection will be complete in FY 82.

FY 1983 Planned: Hardware procurement for the CSF will be completed and development and procurement of the software will be conducted for the Army systems. Tests of the first stages and procurement of the subsequent stages are planned.

Joint Logistics Over-The-Shore II (JLOTS II). Logistics-Over-The-Shore (LOTS) was conducted at Fort Story, Virginia under calm sea conditions. JLOTS II has been approved as a FY 82 joint test with trials in FY 84 to determine the impact and effectiveness of Over-the-Shore Discharge of Containers (OSDOC) and further movement ashore into a Temporary Container Discharge Facility (TCDF). This will demonstrate the Services' ability to discharge containerhips at locations which do not have specialized port facilities, and will test the capability of improved containerhip discharge equipment. This equipment and the concept will be tested in a joint Service RDF environment at a site with state three seas. An Army Transportation Battalion, a Naval Beach Troop, and a Marine Support Element will be required. The test involves compatibility and suitability determination of containerhips, Lighter Aboard Ship (LASH) vessels, motion compensating cranes, causeways, Delong Piers, and Army and Navy lighters and support vehicles. The test was nominated by the Navy, which has been designated lead Service with the Army and Marine Corps as participants. The Navy has prepared an outline test concept, has recommended potential test sites, and is determining test support requirements to allow formulation of cost estimates and budgeting. The scope of the test is being refined from the outline test concept.

FY 1983 Planned Program: The first phase of operations is to be accomplished in FY 1983. This phase is oriented toward deployment operations, using merchant ships to deploy major items of Service equipment required for LOTS-type operations.

Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

Feasibility Determinations for Joint Tests: Feasibility determinations are required to decide if the desired test objectives are achievable, to provide a preliminary estimate of required resources by type and costs, and to provide a list of special and pacing test support needs. These determinations, after coordination with the Services and other OSD elements, provide the basis for designing and planning additional joint tests. Proposed joint tests are analyzed in considerable depth to determine if the test results will resolve current weapon systems problems or provide required information in the design of future weapon systems. These test results must be accomplished within a reasonable time frame so as to provide benefit to the Services and not require excessive funding. As feasibility determinations are completed, decisions are made as to whether proposed joint tests should be pursued or cancelled. It is necessary each year to review carefully the need for future joint tests under realistic two-sided operational conditions.

FY 1983 Planned Program: The FY 1983 effort will result in determining which tests will be conducted in the FY 1984 to FY 1986 timeframe.

Test and Evaluation Independent Activities: In the supervision of test and evaluation, requirements for independent assessment arise on tests conducted by the Services either singly/jointly or with other nations. These assessments are usually directed by either Congressional committees or the Secretary of Defense. There is also an occasional need for assistance in examining certain program issues and in reviewing special aspects of the test and evaluation program. In FY 1981 and FY 1982 independent activities in these categories included the following: development of quantitative guidelines to be used in assessing weapon system operational suitability; development and presentation of a Test and Evaluation Management course; development of an improved approach to evaluation of the Joint Tactical Information Distribution System (JTIDS); development of a text dealing with statistical concepts in test and evaluation; assessment of cruise missile survivability test results; development of guidelines for the test and evaluation of computer software; and preparation of an independent T&E assessment of the DSCS III program.

FY 1983 Planned Program: In FY 1983 emphasis will continue on compatibility of U.S. and NATO weapon systems and the assurance that joint tests conducted by the Services on interacting weapon systems are meeting DoD goals. Funds are required to undertake these independent evaluations as directed by Congress or the Secretary of Defense.

Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

T&E Facility, Instrumentation, and Procedures Studies: In prior years, this activity conducted studies and analyses in support of the development and sizing of the DoD Major Range and Test Facility Base (MRTFB), with particular emphasis on instrumentation and aerial target requirements and capabilities. The object was to assure that the needed capabilities were available for planned test and evaluation activities and the costs incurred were minimized. As part of this activity, the MITRE Corporation conducted specific technical analyses and studies associated with instrumentation and aerial targets, with emphasis on multiple target state vector tracking system capabilities, range radar performance improvements, and force-on-force engagement scoring system concepts. In addition, MITRE conducted studies of infrared aerial target realism, target radar cross section, target concepts for testing high Energy Laser (HEL) weapons, and vector miss distance measurement capabilities with advanced radar techniques. Other studies included range ship fleet sizing alternatives, anti-ship missile target alternatives, full-scale and sub-scale aerial target realism comparisons, and satellite application to test range support. Current activities include: an investigation of instrumentation performance on Electronic Warfare During Close Air Support (EW/CAS) leading toward possible improvements for future joint tests, an assessment of the alternatives for providing anti-air weapons scoring, an assessment of data link alternatives for the application of the NAVSTAR/GPS to range instrumentation, and an assessment of a modified Multiple-Target Instrumentation Radar (MIR) to satisfy range tracking needs.

FY 1983 Planned Program: The effort will include: continuation on the anti-air weapons scoring investigation, further investigations on the application of NAVSTAR/GPS to range instrumentation, analyses supporting the improvement of the Range Measurement System (RMS) for joint tests, and an assessment of support requirements and proposed concepts for force-on-force engagement instrumentation. Investigation will continue in the use of target motion resolution techniques for accuracy improvements of range radar measurements. Studies will continue on aerial targets to aid in selection of better targets for test and training.

Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

2. FY 1984 Planned Program: Funding is required to continue design, planning, and analysis support and to provide administrative and contractual support to Test Directors and their staffs as well as other costs associated with field testing progress for the following on-going joint tests:

Command, Control and Communications
Countermeasures
Data Link Vulnerability
Electro-Optical Guided Weapons Countermeasures/
Counter-Countermeasures

Forward Area Defense Evaluation
Identification of Friend, Foe, or Neutral
Joint Logistics Over-The-Shore II

Proposed FY 1984 joint tests will be coordinated with the other OSD elements, the Joint Chiefs of Staff, and the Service. Selected candidates will be subjected to feasibility determinations to ascertain if the test objectives are achievable, the test can be accomplished within a reasonable time frame, and the tests will not require excessive funding. Based on the determinations, two new joint tests will be selected and funded in the FY 1984 program. With these two new joint tests, there will be a total of eight joint tests underway in FY 1984.

Funds will also be required to provide for Feasibility Determinations of joint tests proposed for subsequent year Independent Activities in the direction and supervision of test and evaluation; and T&E Facility, Instrumentation, and Procedure Studies to continue improving the test facilities base, analyzing and planning instrumentation systems, and responding necessary to meet new requirements.

3. PROGRAM TO COMPLETION: This program supports about eight (8) to ten (10) joint test activities each year on a continuing basis. Generally, completion of a joint test activity requires about four years: 15-18 months for planning and contracting of any new instrumentation; 15-18 months for check test and preparation for a full-scale test; and 9-12 months for the full-scale test and its evaluation and reporting. Feasibility determinations are conducted each year to determine those joint test activities that should be undertaken in future years. T&E Independent Activities are undertaken to evaluate joint Service tests and US Service/Foreign tests on weapon systems as directed by Congress and the Secretary of Defense. Test facilities instrumentation, and test and evaluation practices must be improved on a continuing basis to meet specific joint requirements. The estimated costs to complete the various joint test activities underway in FY 1982 and planned for FY 1983 and FY 1984 are shown in the attached resources funding chart.

Program Element: #65804D
DoD Mission Area: 450 - Test and Evaluation

Title: Test and Evaluation
Budget Activity: 6 - Defensewide Mission Support

Resources: (\$ in Thousands)

	FY 1981 Program	FY 1982 Program	FY 1983 Program	FY 1984 Program	Additional to Completion	Total Estimated Cost
<u>PE 65804D</u>						
<u>Tests Completed in FY 1981</u>						
Advanced Anti-Armor Combat Vehicles	-	-	-	-	-	13,023
Tactical Aircraft Effectiveness and Survivability in Anti-Armor Operations	95	-	-	-	-	20,743
<u>Tests Completed or Terminated in FY 1982</u>						
Central Region Airspace Control Plan	264	299	-	-	-	710
Electronic Warfare During Close Air Support	15,370	5,729	-	-	-	63,570
Joint Direction Finding	-	-	-	-	-	-
Theater Air Defense	222	100	-	-	-	322
<u>Tests Ongoing in FY 1983</u>						
Command, Control, and Communications Countermeasures	538	2,925	6,100	5,400	18,000	33,647
Data Link Vulnerability	8,655	2,624	2,010	500	-	18,060
Electro-Optical Guided Weapons Countermeasures/ Counter-Countermeasures	3,950	4,300	4,600	4,800	-	-
Forward Area Air Defense	314	6,730	12,840	14,056	10,000	43,943
Identification Friend, Foe, or Neutral	2,188	16,100	14,850	14,300	21,500	71,517
Joint Logistics Over-The-Shore II	-	500	5,000	5,400	5,000	15,900
<u>New Starts in FY 1984 - Two</u>						
	-	-	-	3,000	37,000	40,000
<u>Other</u>						
Feasibility Determinations	133	775	800	800	-	-
T&E Independent Activities	838	1,200	1,300	1,300	-	-
T&E Facility, Instrumentation and Procedure Studies	378	818	900	1,000	-	-
TOTAL PE 65804D Funds	32,950	42,100	48,400	50,556	-	-

DIRECTOR OF TEST AND EVALUATION, DEFENSE APPROPRIATION
FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65111D
 DoD Mission Area: 460 - International Cooperative RDT&E

Title: Foreign Weapons Evaluation
 Budget Activity: 6 - Defensewide Mission Support

A. RESOURCES: (\$ in Thousands)

	FY 1981 <u>Actual</u>	FY 1982 <u>Estimate</u>	FY 1983 <u>Estimate</u>	FY 1984 <u>Estimate</u>	Additional <u>to Completion</u>	Total <u>Estimated</u> <u>Costs</u>
Total for Program Element	9,150	10,900	11,600	13,146	Continuing	N/A

B. BRIEF DESCRIPTION OF ELEMENT: This continuing program provides for technical and/or operational evaluation of foreign nations' weapon systems, equipment, and technologies to determine their potential use to elements of the Department of Defense. The bases for selecting a candidate for evaluation include its potential to satisfy an operational need, its ability to meet a deficiency in the current inventory, and its contribution of a component or technology for which there is no similar US alternative. This program element directly supports the policy of the United States that equipment procured for use by personnel of the Armed Forces of the United States stationed in Europe under the terms of the North Atlantic Treaty be standardized or at least interoperable with equipment of other members of the North Atlantic Treaty Organization. This program also provides potential for significant resource savings by avoiding unnecessary duplication in development and identifies viable potential offsets for Foreign Military Sales programs.

C. BASIS FOR THE FY 1983 RDT&E REQUEST: Funds from this program element are provided directly to Service testing facilities to support the test and evaluation of foreign weapons and technology programs nominated by the Services and approved by OSD. Use of these funds includes lease or purchase of test articles, modification of test articles or directly related equipment, technical and operational test support, test data reduction, engineering studies, and refurbishing costs related to returning test or test support articles to original configurations. Specific expenditures will support continuation of evaluation programs initiated in FY 1982, assuming that these efforts are progressing satisfactorily, and will support new efforts initiated in FY 1983. The FY 1983 FWE program nomination and review cycle will start in June 1982 and will be completed on 30 September 1982.

D. COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY: The FY 1983 request is equal to the estimate made a year ago. Added emphasis given by the Services to this program, however, has resulted in FY 1982 requests in excess of \$14.0M against the FY 1982 program of \$10.9M. Even with the careful screening process, which selects only the most promising candidates, a legacy of \$9.0M is being carried over into FY 1983, thus placing a severe constraint on the number of new programs which may be selected in FY 1983.

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Program Element: #63111D
DoD Mission Area: #60 - International Cooperative RDT&E

Title: Foreign Weapons Evaluation
Budget Activity: 6 - Defensewide Mission Support

E. OTHER APPROPRIATION FUNDS: None.

F. DETAILED BACKGROUND AND DESCRIPTION: This was a new program element in FY 1980. In FY 1979 the DoD budget for foreign weapons evaluation totalled \$6.1 million in three Service program elements; \$2.7 million was for the Army (PE 6571-A), \$1.4 million for the Navy (PE 64793N), and \$2.0 million for the Air Force (PE 64736F). During its review of these funds the House and Senate Armed Services Committees conferees suggested that, in the interests of more stringent control, any request for foreign weapons evaluation funds for FY 1980 be placed in the Under Secretary of Defense Research and Engineering (USDRE) budget instead of in separate Service budgets. To accommodate this Congressional guidance, funds for foreign weapons evaluation have been deleted from the Service program elements and placed in USDRE program element 63111D under the direct cognizance of the Director Defense Test and Evaluation. The House Armed Services Committee, in reporting on the DoD Authorization Act for FY 1980, recommended that future authorization requests for Foreign Weapons Evaluation be included in the budget of the Director Defense Test and Evaluation. Accordingly, the request for Foreign Weapons Evaluation funds (PE 63111D) is combined with that of Test and Evaluation (PE 65804D) in the Director of Test and Evaluation, Defense Appropriation.

G. RELATED ACTIVITIES: None

H. WORK PERFORMED BY: Foreign Weapons Evaluation activities are carried out within the potentially benefitting Service. The evaluation of most Army materiel is conducted by the US Army Test and Evaluation Command, Aberdeen Proving Ground, MD, in coordination with the Development command or separate laboratory of the US Army Materiel Development and Readiness Command having responsibility for counterpart US materiel. Army commands and agencies representing user, training, and logistics interests are tasked in a support role appropriate to evaluation requirements. For foreign weapons systems having naval applications, evaluations are monitored by the Office of the Assistant Secretary of the Navy (Research, Engineering and Systems), the Office of the Chief of Naval Operations, and Headquarters, U.S. Marine Corps. Work is performed in various Navy laboratories and test centers such as the Naval Weapons Center, China Lake, CA; the Naval Surface Weapons Center, Dahlgren, VA; the Naval Ship Weapons System Engineering Station, Port Hueneme, CA; and the Naval Ordnance Station, Louisville, KY. For Air Force systems, evaluations are under the management of the Air Force Systems Command, Andrews AFB, MD, and are carried out by its subsidiary units such as the Air Force Flight Test Center, Edwards AFB, CA; the Air Force Avionics Laboratory, Wright-Patterson AFB, OH; and the Armament Development and Test Center, Eglin AFB, FL. Depending on the specific equipment and the arrangements made for its evaluation, foreign companies or governments may provide test articles, spare parts, and support equipment or services as requested.

Program Element: #65111D
DoD Mission Area: 460 - International Cooperative RDT&E

Title: Foreign Weapons Evaluation
Budget Activity: 6 - Defensewide Mission Support

1. PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1982 and Prior Accomplishments: The Army Foreign Weapons Evaluation (FWE) program was initiated in FY 1977. As a result of testing conducted between FY 1977 and FY 1980 two foreign systems were type classified standard A; i.e., adopted for Army use. These were the UK combat support boat which is being used as the US Army bridge erection boat and the Norwegian M72AS Light Antitank Weapon (LAW). A contract was awarded in September 1980 for 120 support boats. The decision to purchase 92,000 LAW rounds has been approved by Congress. The German MAN truck and Swedish BV 202-206 over-snow vehicle test programs were completed in FY 1979. As a result of these evaluations the Army is purchasing over 450 MAN trucks to support several systems and procurement plans have been finalized to procure 250-300 over-snow vehicles. The German Nuclear Biological Chemical (NBC) contamination marking set was approved in FY 1981 and procurement of 52,793 sets is planned through FY 1984.

In FY 1979-80, 34 candidates were identified as potentially meeting US requirements; however, 27 did not meet minimum specifications. The remaining systems entered actual testing and included Norwegian LAW, UK Combat Support Boat, Norwegian M-11 protective mask canister, German NBC contaminated area marking set, German 5.56mm plastic training ammunition, German 4.2" mortar training device, and Norwegian SANATOR lightweight contamination unit. Of these, the Norwegian LAW, UK Combat Support Boat, and German NBC contaminated area marking set have been accepted for procurement while testing is continuing on the other systems. In FY 1981 12 candidates were identified as potentially meeting US requirements but four did not meet minimum specification. Remaining items presently under evaluation include Canadian, Japanese, British replacements for the US M5 smoke-pot, Norwegian M70 20mm multipurpose ammunition, German/British .22 cal rim fire tracer training ammunition, German .50 cal plastic training ammunition, German 7.62mm cal plastic training ammunition, German DM82 hand grenade fuze, German inflatable decoy for HAWK missile system, German 5.56mm plastic training ammunition, German large caliber bore brushes, and the British MK2 portable field shelter.

In FY 1982, the Army also expects to continue evaluation on eight additional systems: EOD body armor, small mobile potable water chiller, 6000 lb rough terrain forklift, electric missile handling forklift, steam jet cleaner, military motorcycles, vehicle loading ramp, 7.5-10 ton wheel-mounted cranes.

In FY 1981, the Navy undertook ten programs including the continuation of Vertical Launch Sea Sparrow, SHINPADS, Raufoss ammunition, Navy Low Cost Targets, and 76mm fuzes and the initiation of the Swedish Carl Gustaf 84mm recoilless rifle, British Osborne MK 1 acoustic minesweeping system, French PAP 104 mine neutralization system, French Durandal airfield attack weapon, and British Groundsat PTR 3411 tactical radio system. Testing has been completed on Vertical Launch Sea Sparrow and SHINPADS and is currently being evaluated by the Navy. Other programs are still in process. New programs initiated in FY 1982 include British Searchwater Radar, French Telimir infra-red inertial navigation system calibration unit, British Versatile Exercise Mine System, and British Integrated Communication System. Several other programs are being considered for funding dealing with USMC requirements and Navy gun and munitions requirements. Two major systems, the Italian Melara gun and Netherlands SM-25 fire control systems, have been procured to date as a result of the FWE program and current programs have significant potential for additional procurement.

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Program Element: #65111D
DoD Mission Area: 460 - International Cooperative RDT&E

Title: Foreign Weapons Evaluation
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The Air Force FWE program was initiated in the early 1970 timeframe. Early test programs evaluated the French Matra 250kg high drag bomb, the interoperability characteristics of the GAU-8 30mm ammunition with the Swiss Oerlikon MCA gun system, and the Raufoss multipurpose or fuseless high explosive ammunition concept. Additionally, screening tests were conducted on seven foreign 9mm handguns. The FY 1980 program was directed at an in-depth evaluation of the Canadian CRV-7 rocket, French BAP 100 and Durandal airfield attack weapons. Additionally in FY 1980 the AF initiated the evaluation of Israeli munitions handling equipment and a joint Navy/AF evaluation of a foreign long wavelength infrared (LWIR) seeker. The planning phase of a 12-month Raufoss ammunition evaluation was also begun to concentrate on the manufacturing and technical data base required to support the newly signed manufacturing license agreement with Raufoss of Norway and will specifically investigate application of the Raufoss concept to GAU-8 30mm ammunition.

The Air Force FY 1981 FWE program centered around the continuation of testing associated with the BAP 100 and Durandal airfield attack weapons, the Israeli munition handling equipment, Raufoss ammunition, and a new evaluation which will address the effectiveness of a recently developed German submunition. The study of the Raufoss fuseless concept has led to the purchase of a license agreement with Raufoss which permits manufacture of the ammunition in this country. Additionally, a manufacturing technology study is now being initiated to support specific application of Raufoss to 30mm ammunition.

The Air Force FY 1982 program will examine the German STABO and British SG-357 airfield attack cratering submunitions as alternatives to the US VAM submunition. Also, to be initiated, are evaluations of the German MUSPA and British HB-876 area denial mine submunitions for airfield attack requirements and the German low altitude dispenser technology in support of wide area antiarmor munitions and airfield attack requirements. The Air Force will also initiate evaluation of a French remote color map reader addressing the night attack requirement and evaluate various chemical defense garments and systems for application to US needs.

2. FY 1983 PLANNED PROGRAM: Continued emphasis will be given to the selection of candidate programs with maximum interoperability and standardization potential in order to increase the readiness posture of our forces. The FY 1983 request is the minimum required to support continuation of current programs and allow the initiation of a very few new programs in FY 1983. Continued emphasis will be placed on use of existing Memorandums of Understanding and Data Exchange Agreements which provide for exchange of T&E data and the loan or lease (vice purchase) of test hardware whenever possible. Fund expenditure in FY 1983 will support continuation of the programs previously mentioned and initiation of new programs considered in conjunction with continuing programs in September 1982.

3. FY 1984 PLANNED PROGRAM: Evaluations begun in FY 1983 will be continued based on the merits of their progress. New programs proposed by the Services will be reviewed by OSD and selected based on Service operational requirements and technology data base needs.

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